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Trading-off the Income Gains and the Inequality Costs of Trade Policy*

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Abstract

This paper characterizes the trade-off between the income gains and the inequality costs of trade using survey data for 54 developing countries. Tariff data on agricultural and manufacturing goods are combined with household survey data on detailed income and expenditure patterns to estimate the first order effects of the elimination of tariffs on household welfare. We assess how these welfare effects vary across the distribution by estimating impacts on the consumption of traded goods, wage income, farm and non-farm family enterprise income, and government transfers. For each country, the income gains and the inequality costs of trade liberalization are quantified and the trade-offs between them are assessed using an Atkinson social welfare index. We find average income gains from liberalization in 44 countries and average income losses in 10 countries. Across countries in our sample, the gains from trade are 1.8 percent of real household expenditure on average. We find overwhelming evidence of a trade-off between the income gains (losses) and the inequality costs (gains), which arise because trade tends to exacerbate income inequality: 46 countries face a trade-off, while only 8 do not. These trade-offs are typically resolved in favor of lower tariffs. In the majority of developing countries, the prevailing tariff structure thus induces sizeable welfare losses.

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1 Introduction

The recent wave of 'new' trade models has rekindled interest in the gains from trade. The results and theorems on the aggregate gains from trade in Dixit and Norman (1980, 1986) have been extended by Arkolakis, Costinot and Rodriguez-Clare (2012), Costinot, Donaldson and Komunjer (2012) and Costinot and Rodriguez-Clare (2014).[1] Concurrently, there has also been a renewed interest in the distribution of the gains from trade. These are the focus of Porto (2006), Fajgelbaum and Khandelwal (2015), Atkin and Donaldson (2015), and Atkin, Faber and Gonzalez-Navarro (2016).[2] In this paper, we combine these two questions and assess the income gains relative to the inequality costs of trade policy. Using survey data for 54 developing countries, we explore the potential trade-off between the gains from trade and the distribution of those gains and we provide a quantification of the inequality-adjusted welfare gains from trade. The evaluation of this trade-off is important, especially because free trade is often opposed on inequality grounds.

We develop a comprehensive model that describes how trade policy affects the real income of different households. Tariffs determine domestic prices which affect households both as consumers and as income earners. As consumers, households are affected through the cost of the entire bundle of traded consumption goods. Similarly, household income is affected through changes in the returns to household production activities, crop growing, family businesses, labor earnings, and government transfers. Our model encompasses all these mechanisms. Following Deaton (1989), we use a first order approximation to measure how real income changes with trade protection or trade liberalization.

We then combine tariff data on various goods with household survey data on detailed income and expenditure patterns to estimate these first order welfare effects for 54 low and middle income countries. With estimates of the welfare effects of trade liberalization for each household, we study the aggregate gains from trade (as in Arkolakis, Costinot and Rodriguez-Clare, 2012) and the distribution of the gains from trade (as in Porto, 2006).

[1] See also Artuc, Lederman and Porto (2015), Caliendo and Parro (2015), Melitz and Redding (2015), Arkolakis, Costinot, Donaldson and Rodriguez-Clare (2015), and Caliendo, Dvorkin and Parro (2016).

[2] See also Nicita, Olarreaga and Porto (2014), Faber (2014), Goldberg and Pavcnic (2007), Topalova (2010), Kovak (2013), Autor, Dorn and Hanson (2013), Dix-Carneiro and Kovak (2017).

Using an Atkinson Social Welfare function (Atkinson, 1970), we assess the trade-off between the income gains and the inequality costs. Our joint study of the gains from trade and their distribution across households contributes to an incipient strand of literature including Antras, de Gortari and Itskhoki (2017) and Galle, Rodriguez-Clare and Yi (2017).

It is useful to put our methodological approach into context. Arkolakis, Costinot and Rodriguez-Clare (2012) quantify the gains from trade by deriving a sufficient statistic to compare autarky with the status quo. Subsequent literature has developed extensions allowing for imperfect competition (Arkolakis, Costinot, Donaldson and Rodriguez-Clare, 2015), labor market frictions (Caliendo, Dvorkin and Parro, 2016), and productivity advantages (Melitz and Redding, 2015). Work on the distributional effects identifies instead winners and losers from trade. Much of this literature builds on Deaton's (1989) first order effects approach, both on expenditures and incomes. Porto (2006) studies the distribution of the household welfare effects across the income distribution, Nicita, Olarreaga and Porto (2014) explore the poverty bias of trade policy (the welfare effects of the poor relative to the welfare effects of the rich), and Atkin, Faber and Gonzalez-Navarro (2016) investigate the distribution of the household welfare effects from FDI. Another branch of the literature examines distributional effects in a Arkolakis, Costinot and Rodriguez-Clare (2012) setting. Fajgelbaum and Khandelwal (2015) introduce non-homothetic preferences and focus on expenditures only. Costinot, Donaldson and Komunjer (2012) and Galle, Rodriguez-Clare and Yi (2017) adopt a Ricardo-Roy model and focus on both expenditures and wages. A distinctive feature of this paper is that we merge these two approaches looking at both average gains from trade and their distributional impacts.

We find average income gains from liberalization in 44 countries and average income losses in the remainder 10 countries. On average, the developing countries in our study enjoy gains from trade equivalent to 1.8 percent of real household expenditure. This is mostly because the consumption gains from lower prices dominate the income losses from reduced protection.

The distributional impacts of liberalization are highly heterogeneous, across both countries and households. We find that the equality gains, the change in social welfare associated with these distributional impacts, are negatively correlated with the average

income gains. Inequality costs arise primarily because trade exacerbates nominal income inequality, while the consumption gains tend to be more evenly spread. This creates tradeoffs between the income gains and the equality gains in 46 of the 54 countries in our sample. Such trade-offs are typically resolved in favor of lower tariffs. In 39 countries, liberalization would result in inequality-adjusted welfare gains for a wide range of empirically plausible values of inequality aversion. In 9 countries that face trade-offs, protectionism would instead be welfare enhancing for plausible values of inequality aversion. Finally, there are 6 countries where the trade-offs are acute, in which the presence of welfare gains or losses depends crucially on the presumed level of inequality aversion and policy prescriptions are consequently more equivocal. These results imply that in the majority of developing countries in our study, the prevailing pattern of protection induces sizeable welfare losses.

The rest of the paper is organized as follows. Section 2 sets up the model and derives the formulas for the welfare effects of trade policy. Section 3 uses the tariff data and the survey data to estimate those welfare effects in 54 countries. Section 4 discusses the gains from trade and their distribution. Section 5 evaluates and quantifies the trade-off between income gains and inequality costs of trade. In addition, it decomposes equality gains into consumption equality gains and income equality gains. Section 6 concludes.

2 Tariffs and Household Welfare

In this section, we develop a detailed model that defines how trade protection affects the real income of the household. We first discuss the determinants of household welfare before turning to the impacts of tariff cuts.

2.1 Household Welfare

We adopt and extend the standard model of Deaton (1989), Porto (2005, 2006), and Nicita, Olarreaga and Porto (2014). Following Dixit and Norman (1980) and Anderson and Neary

(1996), to study household well-being we utilize the *trade* expenditure function, V^h:

$$(1) \quad V^h(\mathbf{p}, v^h, u^h) = y^h(\mathbf{p}, v^h) - e(\mathbf{p}, u^h),$$

where h is the household index, $y^h(\cdot)$ is the household income generating function, which depends on a vector of prices $\mathbf{p}$ and on household endowments v^h, and $e(\cdot)$ is the expenditure function, which depends on prices and on the required utility u^h. We use the trade expenditure function V^h because we are interested in the impact of trade on both incomes and expenditures.[3]

Households consume traded and non-traded goods. Total expenditure is:

$$(2) \quad e(\mathbf{p}^T, \mathbf{p}^{NT}, u^h) = \sum_{j \in T} p_j c_j^h + \sum_{k \in NT} p_k c_k^h,$$

where $\mathbf{p}^T$ is the vector of traded goods prices p_j, with consumption c_j^h, $j \in T$, and $\mathbf{p}^{NT}$ is the vector of non-traded goods prices p_k with consumption c_k^h, $k \in NT$.

The household income generating function is given by:

$$(3) \quad y^h = l_w^h + \sum_{j \in T} \pi_j^h(\mathbf{p}^T) + \sum_{k \in NT} \pi_k^h(\mathbf{p}^{NT}) - T^h,$$

where l_w^h is labor income (which depends on wages), π_j^h are farm profits obtained from various household production activities j in traded sectors (such as sales of cotton, tobacco, or maize), π_k^h are profits from non-traded family business activities, and T^h are taxes paid to (or transfers received from) the government.[4]

The distinction between π_j^h and π_k^h is conceptually useful. In the household surveys of agrarian economies, as most of our sample countries are, households report two main sources of agricultural sales income. Many households produce food crops (maize, wheat,

[3]Deaton (1989) uses the indirect utility function to measure household welfare but ignores the private marginal utility of money, which is equivalent to working directly with the changes in real income, as we do. An alternative representation using the household expenditure function leads to the same qualitative approach. See Porto (2006).

[4]Because of data constraints, we do not deal with other types of transfers (e.g., remittances), nor with savings.

rice) and/or cash crops (cotton, tobacco, cocoa). Cash crops are sold directly in the market. Food crops are often partly consumed by the household (this is autoconsumption), with the surplus sold in the market. These sources of agricultural production income are included in π_j^h. The household may also own a (small) business or family enterprise (basic agricultural processing, small shops, odd-jobs). Income from sales of these activities is captured by π_k^h. Furthermore, in equation (3), labor income includes wages earned in different activities in both traded and non-traded sectors (e.g., manufacturing, services, retail trade, government). Earnings from self-employed activities are included in π_j^h or π_k^h, depending on whether or not the good in question is tradable.[5]

Our coverage of income sources embeds the analysis in different papers of this literature. Deaton (1989) and Benjamin and Deaton (1993) work with income earned from sales of agricultural production (rice in Thailand and cocoa and coffee in Côte d'Ivoire, respectively). Porto (2006) introduces wage income. Nicita, Olarreaga and Porto (2014) investigate sales of agricultural products and wages. Atkin, Faber and Gonzalez-Navarro (2016) use income from family enterprises. This paper covers all these activities including agricultural sales income, labor earnings, income earned in household enterprises in traded sectors, and government transfers.

2.2 The Impacts of Tariff Changes

As most of the related literature does, we adopt a two-step approach. In the first step, trade policy affects the prices of traded goods. In the second step, the induced changes in the prices of traded goods affect household expenditures in all goods and incomes from all activities.

To see how the first step works, let τ_i be the instrument of trade protection for sector i. We assume that the country is small and thus faces exogenously given international prices p_i^*. Throughout the analysis, we assume perfect price transmission (i.e., unitary pass-through

[5]Consider a household that produces tomatoes, selling some in the market and using the rest to prepare tomatoes sauce through a household enterprise. Sales of (raw) tomatoes are classified as agricultural profits affected by tariffs on tomatoes; sales of tomato sauce are categorized as enterprise income and are affected by tariffs on processed food products. A worker employed by a tomato sauce producer earns wages in the food sector, whereas someone employed by a street tomato vendor earns wages in retail trade.

elasticities) from tariffs to domestic prices.[6] As a result:

$$(4) \quad d\ln p_i = \frac{1}{1+\tau_i} d\tau_i.$$

If full trade liberalization is assumed so that $d\tau_i = -\tau_i$;

$$(5) \quad d\ln p_i = -\tau_i/(1+\tau_i).$$

In the second step, these price changes create impacts on household expenditures on traded goods via $e^h = e(\mathbf{p}^T, \cdot)$ and on household income via profits from enterprises in traded sectors, $\pi_i^h = \pi_i(\mathbf{p}^T, \cdot)$, and labor income l_w^h . There are also impacts on tariff revenue and thus on household transfers T^h.

To derive the welfare impacts of the changes in tariffs, differentiate (1) with respect to τ_i to get:

$$(6) \quad \frac{dV_i^h}{e^h} = -\left(-s_i^h + \phi_w^h \frac{\partial l^h}{\partial p_i}\frac{p_i}{l^h} + \phi_i^h\right)\frac{\tau_i}{1+\tau_i} + \Psi_i^h,$$

where s_i^h is the share of traded good i in the consumption bundle of household h, ϕ_i^h is the income share derived from the sales of traded good i, ϕ_w^h is the share of labor income, $(\partial l^h/\partial p_i)/(p_i/l^h)$ is the elasticity of labor income of household h with respect to prices p_i; and $\Psi_i^h = dT^h/e^h$ is the amount of income tax dT^h (relative to household expenditure or income) needed to compensate for the loss of government revenue incurred by eliminating tariffs.

The interpretation of this equation is straightforward. After a price change caused by tariff cuts $d\ln p_i = -\tau_i/(1+\tau_i)$, the first order effects on real income can be well-approximated with the corresponding expenditure and income shares. In the language of Deaton (1989), because we are working with tariff cuts and price declines, net-consumers benefit while net-producers suffer. In our setting, the net position of a household is defined in an extended

[6]We assume perfect price transmission because we do not have data to estimate the pass-through elasticities. Our assumption does not imply that world, producer and consumer prices are equal, but simply that they are proportional to each other. See Nicita (2009) and Ural Marchand (2012) for estimates of imperfect pass-through.

model including not only consumption and production of traded goods but also labor income, enterprise income and government transfers. Note that equation (6) is actually the (negative of the) compensating variation, the monetary transfer that would allow household h to attain utility u^h without tariffs.

As in Nicita, Olarreaga and Porto (2014), we want a measure of the welfare effects generated by the *entire* structure of tariff protection. To obtain it, we sum the changes in welfare in (6) over all traded goods i to get:

$$(7) \quad \widehat{V}^h = \frac{dV^h}{e^h} = \sum_i \frac{dV_i^h}{e^h},$$

where $\widehat{V}^h$ is the proportional change in household real income. In the remainder of the paper, we estimate the different components of equation (7) and study them in detail. We also use equation (7) to build ex-post counterfactual distributions. Let x_0^h be the observed, ex-ante level of real household income (from the data compiled in the household surveys). The counterfactual real income $\widehat{x}_1^h$ is

$$(8) \quad \widehat{x}_1^h = x_0^h(1 + \widehat{V}^h).$$

Much of what we do below hinges on the comparison of the ex-ante and ex-post distributions of income.

3 Estimating the Welfare Impacts of Trade Policy

To estimate the welfare impacts of trade policy, we need to measure the different components of equations (6) and (7). The data needed to estimate impacts on consumption and production of traded goods, labor income and home enterprise income can be found in standard household surveys. Trade policy and trade policy data come from United Nations COMTRADE and UNCTAD TRAINS, which classify goods using the Harmonized System (HS) so that tariffs and imports are available at HS-6 level. Household surveys use different nomenclatures of goods produced and consumed. To match trade data and household

survey data, we use and improve upon the templates and concordances developed by Nicita, Olarreaga and Porto (2014). In short, we first aggregate goods in the household surveys to 2-digit and 4-digit categories. We then aggregate tariff and trade data from COMTRADE to those categories. See Appendix A for details.

3.1 Trade Policy and Price Changes

In the empirical application that follows, good i represents one of the product classifications from the expenditure, income and home-consumption templates modules of the household surveys. Each of these classifications includes many finer product groups from the HS classification. We compute weighted average tariff rates τ_i for each of our survey categories:

$$\tau_i = \sum_{c,n \in i} \tau_{c,n} \frac{m_{c,n}}{\sum_{c,n \in i} m_{c,n}}, \tag{9}$$

where n is an HS-category that belongs to survey-category i and $m_{c,n}$ are imports of good n from country c. The results are shown in Table 1. We report the average tariff for our 2-digit classification, Staple Agriculture, Non-Staple Agriculture, and Manufactures. Average tariffs are highest for non-staple agricultural goods (14.4 percent). They are lower for staple agricultural goods (10.8 percent) and manufactures (10.9 percent). These averages mask substantial variation in trade barriers across countries. Average tariffs on non-staple agricultural goods range from as high as 46.1 percent in Bhutan to as low as 1.9 percent in Indonesia. Also, countries with higher tariffs in agriculture (staple and non-staple) tend to have higher tariffs on manufactures as well.

Using the full price transmission assumption (equation 5), we calculate the price changes induced by the elimination of tariffs as follows:

$$\Delta \ln p_i = \frac{p_i^* - p_i^*(1+\tau_i)}{p_i^*(1+\tau_i)} = -\frac{\tau_i}{1+\tau_i}. \tag{10}$$

3.2 Expenditure and Income Shares

To measure the first order welfare effects we retrieve the expenditure shares s_i^h and the income shares ϕ_i^h from the household survey modules. Appendix Table A1 lists the countries included in the analysis, together with the corresponding household survey, the year of the survey and the sample size. Our analysis covers all low income countries for which appropriate household survey data were available, as well as the majority of lower middle income countries. To minimize the role of measurement error, we exclude households in the top and bottom 0.5% of the status quo expenditure distribution in all our analyses. All statistics derived from household surveys presented in the remainder of the paper are weighted using survey weights. For the relatively few surveys for which survey weights are not available, we simply assume each household has the same weight.

Expenditure shares are reported in Table 2. We show averages for six major expenditure aggregates, namely Staple Agriculture, Non-Staple Agriculture, Manufactured Goods, Non-Traded Goods, Other Goods, and Home Consumption. Expenditure on food is the dominant expenditure category, accounting on average for 45 percent of all household spending across countries, which is not surprising since the bulk of countries in our sample are low income countries with an average poverty rate of 35 percent (using national poverty lines) and an average GDP per capita of 1879 USD. This focus on poor countries also helps explain why home consumption is important, accounting for an average budget share of 17 percent across countries and for more than a third of all expenditure in Ethiopia, Madagascar, Mali and Uzbekistan. Spending on manufacturing goods on average accounts for 17 percent of overall household expenditure, and spending on non-tradables accounts for 15 percent.

Average income shares for staple Agriculture income, Non-Staple Agricultural income, Wages, Family Enterprise Income, Other income, and Own Home Production are reported in Table 3. Wage income is the single most important source of income, accounting on average for 29 percent of household income across countries. The value of autoconsumption accounts for 23 percent of household income. Profits from running farms and other family businesses account for 17 and 13 percent of household income, respectively. These averages hide important heterogeneity across countries, which reflects differences in structural features

of their economies and heterogeneity in survey design (including coverage of different sources of incomes and expenditures).

3.3 Labor Income and Transfers

In order to assess impacts on labor incomes and government revenues, we adopt a simple modeling approach. For labor income, we assume that labor supply to a given sector is fixed. This is consistent with a short-run model, in which workers cannot move across sectors and households do not adjust to the trade shock. In this setting, the change in prices transmit one to one to nominal wages and the elasticity of the wage in sector i with respect to its own price p_i is one, while the elasticities with respect to other prices j is zero. We explore an alternative model in the Appendix. We consider 10 different sectors (see the Income Template in the Appendix).[7]

To estimate the redistribution of the tariff revenue loss, Ψ_i^h, we also follow a simple approach. Denoting import quantity by m_i, we can approximate the loss of tariff revenue as $dR_i = -\tau_i p_i^* m_i$ (ignoring production and consumption responses). Assuming a proportional income tax, the change in income tax paid by household h is $dT^h = d\psi y^h$, where $d\psi$ is the compensatory change in the tax rate. Consequently,

$$\Psi_i^h = -\frac{\tau_i}{1+\tau_i}\frac{M_i}{\sum_h y^h}, \tag{11}$$

where $M_i = p_i^*(1+\tau_i)m_i$ is the value of imports.

4 Income Gains and Inequality Costs of Trade Policy

In this section, we investigate the potential income gains (or losses) and the potential inequality costs (or gains) from trade liberalization. The next section (section 5) investigates the potential trade-off between the two.

[7]Concretely, we construct a dynamic model with labor mobility costs that is characterized by inter industry wage differences (following Artuc, Chaudhuri and McLaren, 2010; Dix-Carneiro, 2014).

4.1 Income Gains from Trade

To be consistent with the literature (e.g., Arkolakis, Costinot and Rodriguez-Clare, 2012), the gains from trade G are defined as the proportional change in aggregate household real expenditures, after liberalization:

$$(12) \quad G = \frac{\sum_h (x_1^h - x_0^h)}{\sum_h x_0^h} = \sum_h \frac{x_0^h}{\sum_h x_0^h} \widehat{V}^h,$$

where $\widehat{V}^h$ is the proportional change in real expenditures of household h which we estimate with equation (7). Thus, G is a weighted average of the welfare effects $\widehat{V}^h$.

Table 4 reports G for 44 countries with positive aggregate gains from trade ($G > 0$). On average, the net gain from tariff liberalization is a 2.5 percentage point increase in real expenditures. The highest gains accrue to Cameroon and Zambia (6.8 and 5.8 percent of real expenditure, respectively). The smallest gains, for Bangladesh and Burundi, are about 0.4 percent of initial expenditures.

Table 5 reports 10 countries in which trade liberalization causes losses ($G < 0$) which average -0.9 percent of real expenditures. In Cambodia, the country with the largest loss, households are estimated to lose 3.1 percentage points of real expenditure. There are also instances of very small, almost negligible, losses as in Mongolia.

Across all countries in the sample, the average gain from trade liberalization is equal to 1.8 percent of real expenditures. The developing world seems to gain from trade.

To establish the sources of the gains from trade, we decompose the average gains into different channels in columns 2-8 of Tables 4 and 5. Households gain on the expenditure side, but they lose on the income side. The consumption gains come from lower prices of tradables, which on average result in (gross) real income gains of 6.4 percent for the winners (Table 4) and 5.1 percent for the losers (Table 5). About two thirds of these gains, on average, are due to lower prices of agricultural goods and one third to lower prices of manufacturing goods. This is a consequence both of the higher expenditure shares on food items in developing countries, and the comparatively high tariffs on agricultural products. Households lose nominal income. Agricultural income losses account for average real income

declines of 1.6 percent across countries with gains and 1.9 percent across countries with losses. Wage income effects create losses of 0.6 percent in countries with gains and 1.0 percent in countries with losses. The reduction in income from enterprises producing tradeable goods is small on average; -0.2 percent of income among winners and -0.1 percent among countries that lose. The biggest driver of income losses is the reduction in government revenue: this channel accounts for 1.5 of the 3.9 percentage points loss in income among winners and 3.1 of the 6.1 percentage point loss among losers.

4.2 The Distributional Effects of Trade

We now turn to the distribution of the gains from the trade, which have been the focus of Porto (2006), Nicita, Olarreaga and Porto (2014), Fajgelbaum and Khandelwal (2016), Atkin, Faber and Gonzalez-Navarro (2016), Faber (2014) and Atkin and Donaldson (2015). Indeed, the average impacts just discussed mask significant heterogeneity across households. This is because the net welfare impact is determined by a combination of initial tariffs as well as income and consumption portfolios. We combine two techniques to explore the distributional effects. We estimate kernel averages of the gains from trade, conditional on household initial well-being (per capita expenditure), and we estimate bivariate kernel densities of the joint distribution of the gains from trade and household per capita expenditure.

For the sake of exposition, we divide countries into two groups using the pro-poor index of Nicita, Olarreaga and Porto (2014). In our application, the pro-poor index is the difference between the average gains for the poor—the bottom 20 percent of the income distribution—and the rich—the top 20 percent. If the index is positive the poor gain proportionately more (or lose proportionately less) than the rich, while the opposite happens when the index is negative. According to this classification, trade liberalization would be pro-poor in 17 countries, while it would be pro-rich in the remaining 37 countries.

We illustrate the case of pro-poor bias in Figure 1 for the cases of Jordan (panel (a)) and Mauritania (panel (b)). Appendix B provides figures for all countries. In Jordan, the kernel average is positive everywhere, so that there are average gains from trade across the income distribution, but the slope of the kernel regression is negative (so that the

poor gain proportionately more than the rich). This pro-poor bias with positive kernel average gains appears in Azerbaijan, Central African Republic, Ecuador, Indonesia, Moldova, Nepal, Pakistan, Papua New Guinea, Rwanda, Yemen and Zambia (see Appendix B). In these countries, liberalization raises incomes across the income distribution and may reduce inequality. Liberalization would not be Pareto improving, however. The bivariate density of the welfare effects and initial income illustrates the dispersion in the welfare effects and the existence of winners and losers in all segments of the per capita expenditure spectrum. A more extreme version of this pattern is shown in panel (b) for the case of Mauritania, where there are average gains for the poor but average losses for the rich. This implies a very strong pro-poor bias. Similar patterns are also observed in Guinea Bissau, Mali, Mongolia and Sri Lanka (see Appendix B). In all these countries, liberalization raises average income and may reduce inequality significantly.

We illustrate the pro-rich bias in Figure 2. In Uzbekistan (panel (a)), the kernel average is always positive at all levels of per capita expenditure, and the slope of the kernel regression is positive, indicating that, on average, the rich gain proportionately more than the poor. Again, some individual households stand to lose, as the underlying bivariate kernel density graph shows. Liberalization lifts incomes throughout the income distribution, but at the expense of potentially higher inequality. This pattern is found in Armenia, Bolivia, Cameroon, Côte d'Ivoire, Egypt, Ethiopia, Georgia, Guatemala, Guinea, Iraq, Kyrgyz Republic, Liberia, Malawi, Mozambique, Nicaragua, Niger, Sierra Leone, South Africa, Tajikistan, Tanzania, Uganda, and Ukraine (see Appendix B). The case of pro-rich bias with average gains for the richest households and losses for the poorest is illustrated in panel (b) for Togo. Liberalization is strongly pro-rich and inequality significantly exacerbated. Similar patterns arise in Bangladesh, Benin, Burkina Faso, Burundi, The Gambia, Kenya, Nigeria, and Vietnam. In panel (c), we show the case of average losses and a pro-rich bias for Ghana. In this country, as well as in Bhutan, Cambodia, Comoros and Madagascar, the poor lose proportionately more than the rich. This is a scenario with average losses as well as increased inequality.

5 The Trade-Off between Income Gains and Inequality Costs

Given the patterns of gains from trade and of the distribution of those gains, we now assess whether there is a trade-off between the income gains and the inequality costs of trade liberalization. This necessarily involves value judgements because different societies, individuals or policy makers may value the gains or losses of some households differently. A tool to describe the trade-off between income inequality and average incomes is the Atkinson social welfare function (Atkinson, 1970):

$$(13) \quad W = \frac{1}{H} \sum_{h} \frac{\left(x^h\right)^{1-\varepsilon}}{1-\varepsilon},$$

where W is social welfare and $\varepsilon \neq 1$ is a parameter that measures the dislike for inequality.[8] When ε=0, every household counts the same and social welfare is just the sum (average) of per capita expenditures. As ε increases, the weights attached to the wellbeing of poorer households increases. In the limit, as ε approaches infinity social welfare is determined by the wellbeing of the very poorest household (as in a Rawlsian social welfare function). It is very important to interpret the Atkinson social welfare function correctly. As Deaton (1997) explains, W in (13) is not necessarily (and more precisely, it seldom is) the object that policymakers maximize when choosing among policy options. Rather, it provides a means of quantifying potential tensions between mean income and its distribution across households.

An important property of the Atkinson social welfare function is that it can be decomposed in a way that is conducive to the assessment of this trade-off. Concretely, we can write

$$(14) \quad W = \mu * (1 - I),$$

[8]For completeness, when $\varepsilon = 1$, we define $\ln W = (1/H) \sum_h \ln x^h$

where μ is mean income and

$$(15)\quad I = 1 - \left(\frac{1}{H} \sum_{h=1}^{H} (x^h/\mu)^{1-\varepsilon} \right)^{1/(1-\varepsilon)},$$

is an implicit measure of income inequality. Social welfare thus depends on average income μ and on the aggregate level of "equality" $(1 - I(\varepsilon))$. This measure of inequality $I(\varepsilon)$ (or the measure of equality $(1 - I(\varepsilon))$) depends on ε and nests a whole family of inequality measures.

Using $W(\varepsilon)$, we can define a measure of the gains from trade that includes a correction for the inequality costs:

$$(16)\quad G(\varepsilon) = \frac{W_1(\varepsilon) - W_0(\varepsilon)}{W_0(\varepsilon)},$$

where W_0 is the ex-ante social welfare, calculated with the observed (x_0^h) income distribution in the presence of trade protection and $W_1(\varepsilon)$ is the counterfactual social welfare under trade liberalization $(\widehat{x}_1^h)$. Given the initial situation and the post-liberalization situation, we can compare W_0 and W_1 using (16). For $\varepsilon = 0$, this is a comparison of mean income, that is, the calculation of the gains from trade (Arkolakis, Costinot and Rodriguez Clare, 2012; Costinot, Donaldson and Komunjer, 2012; Costinot and Rodriguez-Clare, 2014; Artuc, Lederman and Porto, 2015; Caliendo and Parro, 2015; Melitz and Redding, 2015; Arkolakis, Costinot, Donaldson and Rodriguez-Clare, 2015; and Caliendo, Dvorkin and Parro, 2015). For $\varepsilon > 0$, this comparison involves the calculation of the gains from trade with an implicit correction for inequality (Antras, de Gortari, Itskhoki, 2017; and Galle, Rodriguez-Clare, and Yi, 2017). With estimates of $G(\varepsilon)$ for different ε, we can establish whether there is a trade-off between the gains in average incomes and the costs of inequality in its distribution, we can quantify this trade-off, and we can assess it.

For the discussion that follows, we exploit the decomposition of W in equation (14). Note that we can write

$$(17)\quad G(\varepsilon) = G(0) + \frac{\mu_1}{\mu_0} \frac{I_0(\varepsilon) - I_1(\varepsilon)}{1 - I_0(\varepsilon)}.$$

The inequality-adjusted gains from trade are thus equal to the income gains from trade $G(0)$ plus a correction for changes in inequality, which we will refer to as equality gains. The gains from trade $G(0)$ can be positive or negative, as shown in section 4.1. The correction for inequality is governed by the Atkinson inequality index $I(\varepsilon)$, which may depend non-monotonically on ε. If inequality increases for some $\varepsilon_a > 0$ so that $I_1(\varepsilon_a) > I_0(\varepsilon_a)$, then $G(\varepsilon_a)$ incorporates a downward correction for these inequality costs. Conversely, if $I_1 < I_0$ at some ε_b, then the gains from trade are amplified. Note that $G(\varepsilon) > 0$ does not imply no inequality costs per se but rather that their welfare impacts are dominated by the income gains.

Trade-offs arise when income gains and equality gains move in opposite directions, i.e. when $G(0)$ and $\frac{\mu_1}{\mu_0}\frac{I_0(\varepsilon)-I_1(\varepsilon)}{1-I_0(\varepsilon)}$ have opposite signs. This is the case in countries where trade exacerbates inequality but improves average income, and in countries where it reduces inequality at the expense of lowering mean income. In some countries, these trade-offs can even result in reversals of trade policy preferences, in the sense that for certain levels of inequality aversion ε, the inequality adjusted gains from trade may be negative (positive) even though liberalization leads to an increase (reduction) in average income. Since the sign and magnitude of the equality gains can vary with ε both the existence and acuteness of the trade-offs depend on the level of inequality aversion. No trade-offs occur in countries where liberalization leads to both income and equality gains (for all ε) or in countries where it leads to lower income and higher inequality (for all ε).

One of the main findings of our paper is the high prevalence of trade-offs between average incomes and income inequality in the developing world. Among the 54 countries in our sample, 46 face a trade-off and only 8 do not. In 28 of the 46 countries the tradeoffs can be severe enough to generate (potential) reversals in the ranking of trade policy preferences. We first present countries without trade-offs in section 5.1, before discussing countries with trade-offs without trade policy preference reversals 5.2. Section 5.3 presents countries with trade-offs that can generate trade policy preference reversals. Section 5.4 evaluates such trade-offs, whereas section 5.5 decomposes equality gains into consumption and income equality gains.

5.1 No Trade-off Countries

When average income gains emerge together with equality gains, there is no trade-off. The case of the Central African Republic is shown in Figure 3, which plots $G(\varepsilon)$ for $\varepsilon \in [0, 10]$.[9] To obtain confidence intervals for $G(\varepsilon)$ we resample from the observed distribution and bootstrap using 1000 replications. In the Central African Republic, liberalization leads to average welfare gains with a pro-poor bias. The gains in average incomes of 4.2 percent are independent of ε and the pro-poor bias implies that liberalization also leads to equality gains. As ε increases and more weight is put on the poor, these equality gains actually get bigger. As a result, the inequality adjusted welfare gains are increasing in the inequality aversion parameter ε, and exceed 6 percent for large ε. Other countries in which liberalization yields both equality gains and lifts average incomes are Guinea Bissau, Jordan and Yemen. In these countries, liberalization is unambiguously social welfare enhancing.

At the other end of the spectrum lie 4 countries, Comoros, Ghana, Madagascar and Rwanda, which are characterized by average income losses and inequality costs for all ε. In these countries liberalization would be unambiguously social welfare depressing. Figure 4 illustrates the case of Ghana. Since income losses are disproportionately borne by the poor, the inequality adjusted gains from trade are negative and decreasing with ε. For instance, the aggregate losses of –2.0 percent (for $\varepsilon = 0$) are augmented to over –4.2 percent when inequality aversion is high.

5.2 Trade-off Countries without Trade Policy Preference Reversals

There are 46 countries with evidence of a trade-off. In 18 countries, this trade-off is not strong enough to generate reversals of trade policy preferences because liberalization dominates protection at all levels of inequality aversion (in 16 countries) or because protection dominates liberalization (in only 2 countries, notably Bhutan and Cambodia). Figure 5 illustrates the case of Uzbekistan, where liberalization creates average income gains at the expense of

[9]For presentational purposes, we examine $G(\varepsilon)$ for a limited range of $\varepsilon \in [0, 10]$ but the results hold more generally. Results are available upon request but omitted to conserve space.

inequality costs. In Uzbekistan inequality increases smoothly with ε and, as a consequence, the inequality adjusted welfare gains $G(\varepsilon)$ decrease as inequality aversion rises. The gains from trade are $G(0) = 3.3$ percent, while the inequality-adjusted gains for large ε can go down to about only 1 percent. Other countries exhibiting a similar pattern are Armenia, Azerbaijan, Cameroon, Egypt, Guinea, Indonesia, Iraq, the Kyrgyz Republic, Moldova, Pakistan, Tajikistan, Uganda, Ukraine, Uzbekistan, South Africa, and Zambia. Since G(ε) is positive and statistically significant for all ε, liberalization would unambiguously lead to higher social welfare.

Plots of $G(\varepsilon)$ for all these countries are given in Appendix C. We summarize the information contained in Figures 3, 4 and 5 in Table 6, which reports the income gains from trade $G(0)$ (column 1) as well as the equality gains $((\mu_1/\mu_0)(I_0(\varepsilon) - I_1(\varepsilon))/(1 - I_0(\varepsilon))$ for several values of inequality aversion ε. To illustrate, consider the case of Guinea Bissau (a country without a trade-off) in panel (a). The gains from trade are 2.0 percent (column 1). Because inequality declines with liberalization, the equality gains increase with ε. The correction is thus positive and increasing with ε. At $\varepsilon = 2$, for instance, the correction is 0.5 percent and the inequality-adjusted gains are 2.5 percent. At $\varepsilon = 7$, the correction is 1.5 percent and the total inequality-adjusted gains go up to 3.5 percent. Another interesting example is Madagascar, where there are losses from trade of -1.1 percent and increases in inequality costs so that, at $\varepsilon = 2$, the inequality-adjusted losses from trade drop to -2.3 percent and at $\varepsilon = 7$, to -3.4 percent. To illustrate a country with trade-offs (Panel (b)), consider Tajikistan. The gains from trade are 1.9 percent, but inequality increases and consequently there is a downward correction to G. At $\varepsilon = 2$, this correction is –0.1 percent and the inequality adjusted gains drop to 1.8; at $\varepsilon = 7$, the correction is –0.7 percent and the inequality adjusted total gains are 1.2 percent. The table reports many other interesting patterns.

5.3 Trade-off Countries with Trade Policy Preference Reversals

In the remaining 28 countries in our sample, we find evidence of a stronger trade-off which may induce a potential reversal of the ranking of trade policy preferences. This reversal

occurs when $G(\varepsilon)$ changes sign, going from positive to negative or from negative to positive, as ε increases. This means that, depending on the value judgement parameter ε, the social welfare function points to welfare gains associated with trade liberalization or with trade protection. Figure 6 and 7 shows two examples of the existence of such trade-offs. In Benin (Figure 6), there are significant average income gains of 2.2 percent so that $G(0) > 0$. However, as ε increases, trade liberalization creates larger and larger inequality costs so that, eventually, $G(\varepsilon)$ becomes significantly negative. At very large ε, the inequality-adjusted gains approach -4.5 percent. It follows that free trade dominates protection when ε is low, whereas protection dominates free trade when ε is high. Other countries that exhibit similar tradeoffs are Bangladesh, Bolivia, Burkina Faso, Burundi, Ethiopia, The Gambia, Guatemala, Kenya, Liberia, Malawi, Mozambique, Nigeria, Papua New Guinea, Togo, and Vietnam.[10]

Mali (Figure 7) exhibits the opposite pattern; There are significant average losses from trade ($G(0) = -0.4$) but, as ε increases, the equality gains from liberalization end up strictly dominating those losses and the inequality-adjusted gains $G(\varepsilon)$ can reach over 3 percent. Consequently, protection dominates free trade at low ε, while free trade dominates protection at high ε. This also happens in Mauritania and Sri Lanka.

To quantify these policy preference reversals, we define the cutoff value ε^* such that $G(\varepsilon^*) = 0$. The cutoff ε^*, which we refer to as trade-ε^*, is a measure of the inequality aversion to trade liberalization. It is a sufficient statistic to describe the trade-off between mean income and inequality in the presence of trade policy preference reversals. Defining the trade-off in terms of the gains, the value of ε^* shows how intolerant towards inequality a society would have to be in order to make the gains from trade not worthwhile from a social welfare perspective.[11] A high value of ε^* implies a soft trade-off: a society needs to put a heavy weight on the cost of higher inequality to be willing to forgo the gains (always in a social welfare function sense). In the limit case, when trade-ε^* tends to infinity or when trade-ε^* does not exist (as in the countries discussed in sections 5.1 and 5.2), there is no reversal in trade policy preference rankings and, given gains from trade, trade liberalization

[10] See below for a more detailed discussion of some of these countries and their trade-off.

[11] Alternatively, the ε^* shows how much a society would have to value equality to forgo the average gains from trade.

leads to higher social welfare for any ε. By contrast, a low trade-ε^* implies a very hard trade-off because relatively light weights on the inequality costs are enough to offset the gains from trade. It is important to note that while the value of ε^* describes the nature of the trade-off, it is silent about whether this trade-off is socially acceptable.

Table 7 presents estimates of the trade-ε^* (column 1) and its 95% confidence interval (columns 2 and 3). Since the interpretation of the trade-ε^* depends on the sign of the gains, we report results separately for countries that enjoy income gains in panel (a) and countries that suffer income losses in panel (b). The select few countries characterized by multiple (potential) reversals are presented in panel (c).

Among the countries with gains (Panel (a)), the trade-ε^* vary a lot. In some cases, the cutoff can be as low as 0.10 (Burundi), 0.51 (Bangladesh) or 0.56 (Burkina Faso). In other cases, it can be much larger, as in Malawi (7.06) or Guatemala (6.98). To put these numbers in perspective, we canvassed the literature for guidance on what a reasonable value for ε is. Deaton (1997) recommends exploring values of $\varepsilon \in [0, 2]$ when doing policy evaluations. Using experiments, Carlsson, Daruvala and Johansson-Stenman (2005) estimate $\varepsilon \in [1, 2]$ and Layard, Mayraz and Nickell (2008) estimate a value of ε of 1.26. A high ε^* consequently suggests that the trade-offs are soft in the sense that one would have to be implausibly inequality averse in order not to prefer liberalization. This implies a strong presumption in favor of lower tariffs. By contrast, in Burundi, Bangladesh or Burkina Faso, the trade-off would be quite stark. Since the gains from trade are positive but very small, even at low levels of inequality aversion one would prefer protection. In the remaining countries, the trade-off appears to be more moderate, with a substantial number of the estimates of trade-ε lying in the [1,2] interval (1.17 in The Gambia, 1.23 in Togo, 1.47 in Benin, 1.87 in Nigeria, and 1.91 in Vietnam). Kenya (2.49), Ethiopia (3.06), Mozambique (3.51), Liberia (4.41), Papua New Guinea (4.79), and Bolivia (5.81 at the first reversal) are countries with relatively high trade-ε^*, but not quite as extreme as Malawi or Guatemala.

There are countries with trade-offs where the evidence on trade policy reversals is not so compelling. This occurs when the inequality-adjusted gains from trade are not statistically indistinguishable from zero, that is the null hypothesis that $G(\varepsilon) = 0$ cannot be rejected

for a range of ε. We report these cases in columns 4 and 5 of Table 7. In Sierra Leone, for instance, for $\varepsilon > 4.01$, there are inequality adjusted gains from trade ($G(\varepsilon) > 0$) that are not statistically different from 0. Consequently, we cannot rule out a *potential* reversal (from preferring liberalization to preferring protection). Similar scenarios emerge in Niger ($\varepsilon > 6.01$), Nicaragua ($\varepsilon > 6.33$), Côte d'Ivoire ($\varepsilon > 7.02$), Georgia ($\varepsilon > 7.09$), Nepal ($\varepsilon > 8.79$), Tanzania ($\varepsilon > 8.85$), and Ecuador ($\varepsilon > 9.92$). In all these countries, however, the trade policy preference reversal would come about only for levels of inequality aversion that are arguably implausibly large.

Among the countries with aggregate losses (Panel (b)) of Table 7), the estimated trade-ε tend to be low. For instance, we get $\varepsilon^* = 0.05$ in Mongolia, $\varepsilon^* = 0.30$ in Sri Lanka (at the first reversal) and $\varepsilon^* = 0.43$ in Mali. Note that the interpretation in these cases is different because for low ε, trade protection is preferred to liberalization, and, conversely, liberalization is preferred to protection for higher ε. In these countries, a low ε^* thus implies a presumption in favor of lower tariffs, too (assuming plausible, non-zero, levels of inequality aversion). In Mauritania ($\varepsilon^* = 1.63$), trade protection would be preferred under more moderate values of inequality aversion making it harder to infer trade policy prescriptions.

5.4 Assessment

While our results attest to highly heterogeneous welfare impacts of trade liberalization across households and countries, overall the analysis provides overwhelming evidence of a trade-off between income gains and inequality costs of trade policy. In most cases, however, this trade-off is resolved in favor of freer trade. We summarize these observations and results in Figure 8. We plot the value of the inequality-adjust gains from trade $G(\varepsilon)$ against the gains from trade $G(0)$. For our assessment, we use $\varepsilon = 1.5$ because it is in the middle of the empirically plausible interval $[1, 2]$ and because it yields a measure of the Atkison inequality index I that is, in general, close to the Gini coefficient. Since the Gini is often used in discussions about inequality, this is a useful benchmark. If there were only small corrections for inequality, then the pairs $(G(1.5), G(0))$ would lie along the 45 degree line, with larger corrections for those pairs further away. Orthant I hosts countries with average gains as well

as gains after inequality corrections; orthant III hosts countries with average losses with and without inequality corrections. In orthant II, we see countries with losses from trade that turn into gains after the inequality adjustments, and, in orthant IV, those countries with gains from trade that turn into losses with inequality considerations.

For an inequality aversion parameter of $\varepsilon = 1.5$, 16 countries would not face a trade-off. Ten of them would unambiguously benefit from liberalization as they enjoy both income and inequality gains. These countries, which lie in orthant I, above the 45 degree line, are Azerbaijan, Central African Republic, Ecuador, Guinea Bissau, Indonesia, Jordan, Pakistan, Papua New Guinea, Nepal, and Yemen. The remaining six countries, Bhutan, Cambodia, Comoros, Ghana, Madagascar and Rwanda, would unambiguously prefer protectionism as trade liberalization leads to both income losses and inequality costs (they lie in orthant III, below the 45 degree line).

A total of 38 countries would exhibit trade-offs (for $\varepsilon = 1.5$). In 31 countries, the trade-off is resolved in favor of liberalization. Twenty eight countries would show income gains and inequality costs, but inequality-adjusted gains from trade liberalization. These are the countries in orthant I, below the 45 degree line. Three countries (Mali, Sri Lanka, Mongolia) would show instead income losses but sufficient high equality gains so that there are inequality-adjusted gains from trade in the end (for $\varepsilon = 1.5$). These are countries in orthant II.

In 7 countries the trade-off is instead resolved in favor of protection because tariffs lead to higher inequality-adjusted welfare. One country, Mauritania (orthant III, above the 45 degree line), would face income losses and equality gains, which, for $\varepsilon = 1.5$, are not enough to compensate for those losses. In six countries, Bangladesh, Benin, Burkina Faso, Burundi, The Gambia and Togo, the inequality costs dominate the income gains. These are in orthant IV.

It turns out that the resolution of the trade-off is very stable for different values of plausible inequality aversion. In Figure 9, we reproduce Figure 8 for $\varepsilon = 1$ (panel (a)) and $\varepsilon = 2$ (panel (b)). As it can be seen, there are only a few countries where the trade policy prescriptions are more equivocal. For $\varepsilon = 1$, Benin, The Gambia, and Togo jump from

orthant IV to orthant I (thus preferring liberalization instead of protection). For $\varepsilon = 2$, Vietnam and Nigeria jump from orthant I to orthant IV (thus preferring protection) while Mauritania jumps from orthant III to orthant II (thus preferring liberalization).

A fundamental conclusion of this analysis is therefore that the potential trade-off between mean income and its distribution resolves, in many instances, in favor of lower tariffs (liberalization) rather than higher tariffs (protection). Concretely, for empirically plausible levels of inequality aversion, liberalization is expected to enhance welfare in 39 countries and to reduce it in 9 countries. Only in the remaining 6 countries are the policy implications more equivocal.

These results raise questions about why these countries protect their economies. While our analysis does not inform us about this issue, potential reasons include political economy considerations, rent re-distribution to non-labor income (capital), and tariff revenue capture (Grossman and Helpman, 1994; Krueger, 1974) as well as the need for government revenue in countries in which income taxes are difficult to collect (Besley and Persson, 2013). Theories of social mobility and redistribution that combine psychology and political economy may also help explain protectionism (Picketty, 1995; Benabou and Tirole, 2006). Whatever the reason for it, protection can be very costly in terms of the social welfare aggregator W. In the Appendix we show that this conclusion and the qualitative pattern of results are robust to using an alternative model that allows for labor market frictions and responses of non-traded goods prices.

5.5 Decomposing Equality Gains

How do the trade-offs described above emerge? To answer this question, Table 8 decomposes the equality gains (or losses) into consumption equality gains and (nominal) income equality gains. To calculate these, we estimate two counterfactual scenarios; one in which liberalization solely impacts consumption (and does not impact income), and one in which it solely impacts income (and does not impact consumption). We compute the consumption and income equality components using equation (17) (recall that equality gains are equal to

$\frac{\mu_1}{\mu_0}\frac{I_0(\varepsilon)-I_1(\varepsilon)}{1-I_0(\varepsilon)}$).[12]

As much as there is heterogeneity in the trade-offs, there is a marked heterogeneity in the income and consumption equality components. Note, however, that the consumption equality gains are positive yet small in the majority of countries. As consumers, the poor seem to benefit disproportionately from liberalization, in part because they spend a larger share of their budget on food items, which are subject to comparatively high tariffs. By contrast, the income component is overwhelmingly negative across countries, reflecting the fact that trade liberalization creates income inequality costs that are disproportionately borne by poorer households. Whereas the consumption equality gains on average increase only slightly as inequality aversion rises, the average income inequality costs tend to sharply increase (i.e., become more negative) with ε. The trade-offs between the aggregate gains and aggregate inequality costs are thus predominantly driven by income inequality. This finding shows that the income losses associated with trade liberalization are borne disproportionately by the poorer segment of the income distribution, whereas the consumption gains are more widely spread.

6 Conclusion

Using household survey data for 54 low and middle income countries harmonized with trade and tariff data, this paper offers a quantitative assessment of the income gains and inequality costs of trade liberalization and the potential tradeoff between them.

A stylized yet comprehensive model that allows for a rich range of first order effects on household consumption and income is used to quantify welfare gains or losses for households in different parts of the expenditure distribution. These welfare impacts are subsequently explored by deploying the Atkinson social welfare function that allows us to decompose inequality adjusted gains into aggregate gains and equality (distributional) gains.

[12]Consumption and income impacts may interact, such that the total equality gains from trade are not simply equal to the sum of the consumption equality gains and income equality gains; to assess the importance of these type of interaction effects, we calculated "residual" equality gains as the difference between total equality gains and the sum of income and consumption equality gains. The residual was typically very small and is therefore not presented here.

Liberalization is estimated to lead to income gains in 44 countries in our study, and to income losses in 10 countries. The developing world as a whole would enjoy gains of about 1.8 percent of real household expenditures, on average. These income gains are negatively correlated with equality gains, such that liberalization typically entails a trade-off between average incomes and income inequality. In fact, such trade-offs arise in 46 out of 54 countries, and are primarily the result of trade exacerbating income inequality. By contrast, consumption gains tend to be more evenly spread across households.

While trade-offs are prevalent, our findings also suggest that liberalization would be welfare enhancing in the vast majority of countries in our study: in a large part of the developing world, the current structure of tariff protection is inducing sizeable welfare losses. Explaining what drives these patterns is beyond the scope of this paper but an interesting avenue for future research.

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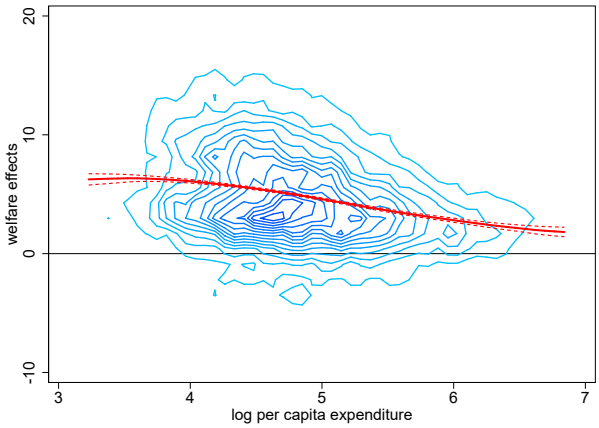
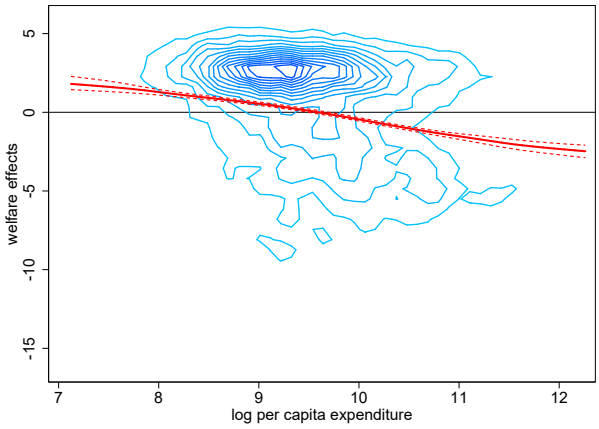
Figure 1
Patterns of Distributional Impacts
Pro-Poor Bias

(a) Jordan



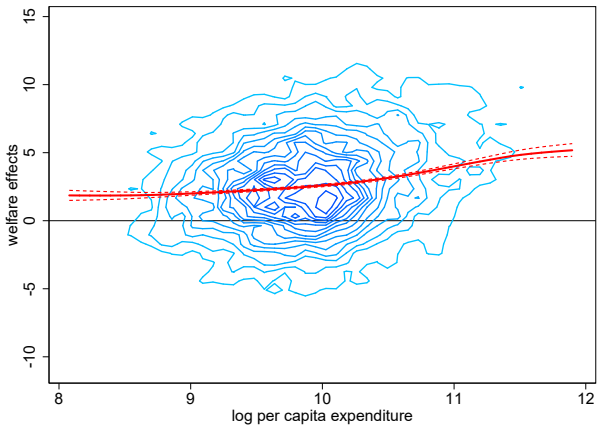
(b) Mauritania



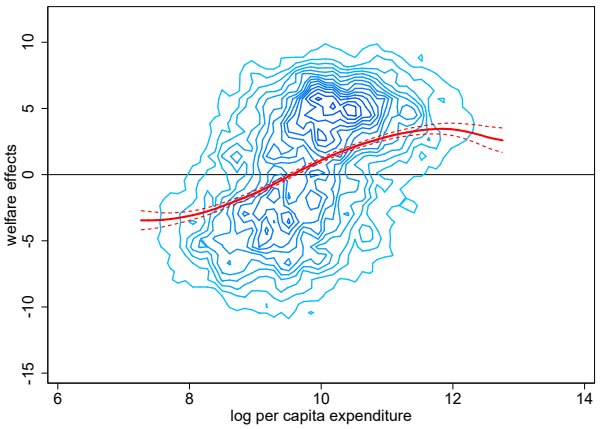
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-poor bias if the average proportional real income gains accruing to households in the the bottom 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the top 20% of the pre-liberalization real income income distribution.

Figure 2
Patterns of Distributional Impacts
Pro-Rich Bias

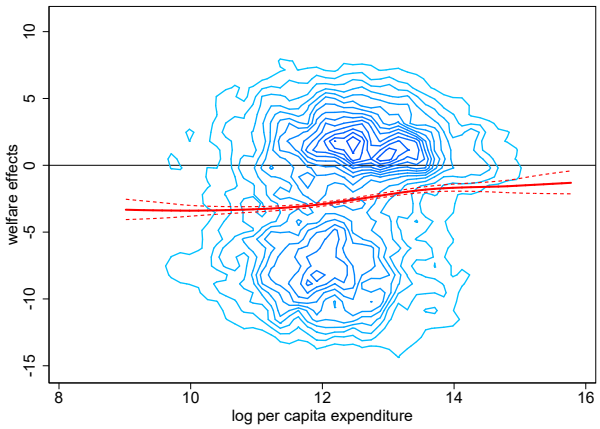
(a) Uzbekistan



(b) Togo



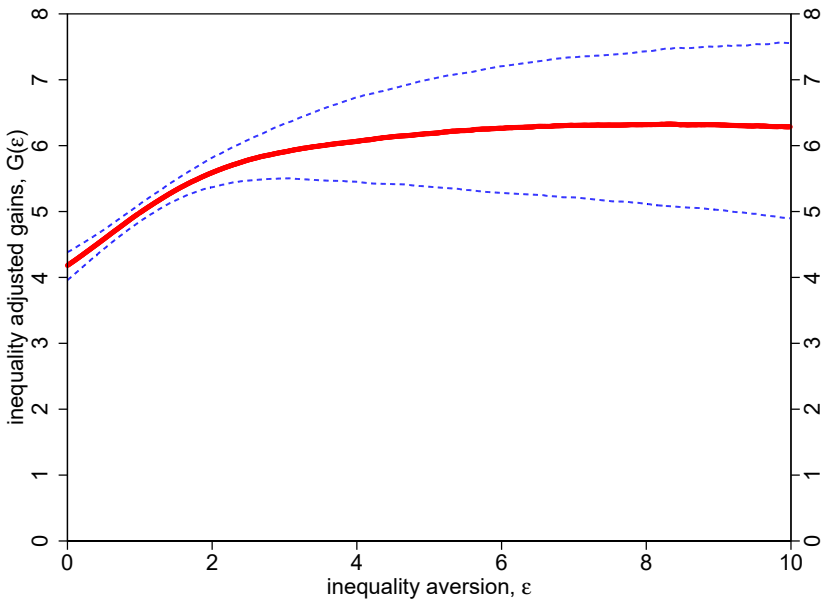
(c) Ghana



Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure 3
No Trade-off
Income Gains and Equality Gains

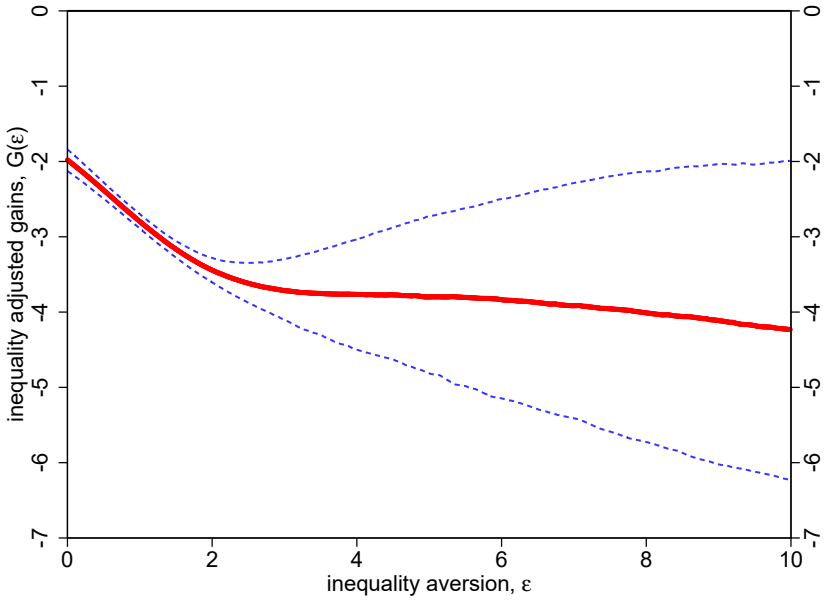
(a) Central African Republic



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure 4
No Trade-off
Income Losses and Inequality Costs

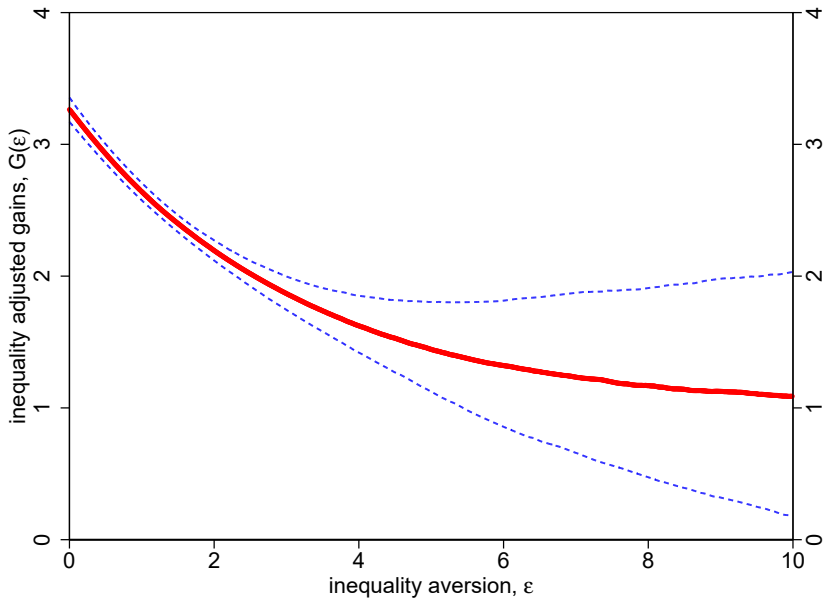
(a) Ghana



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure 5
Trade-off Without Policy Preference Reversal
Income Gains and Inequality Costs

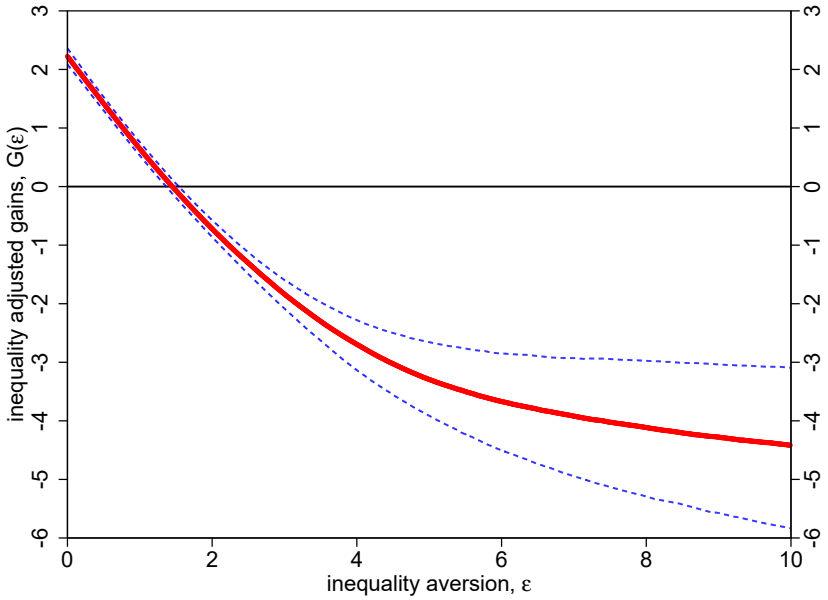
(a) Uzbekistan



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure 6
Trade-off with Trade Policy Preference Reversal
Income Gains and Inequality Costs

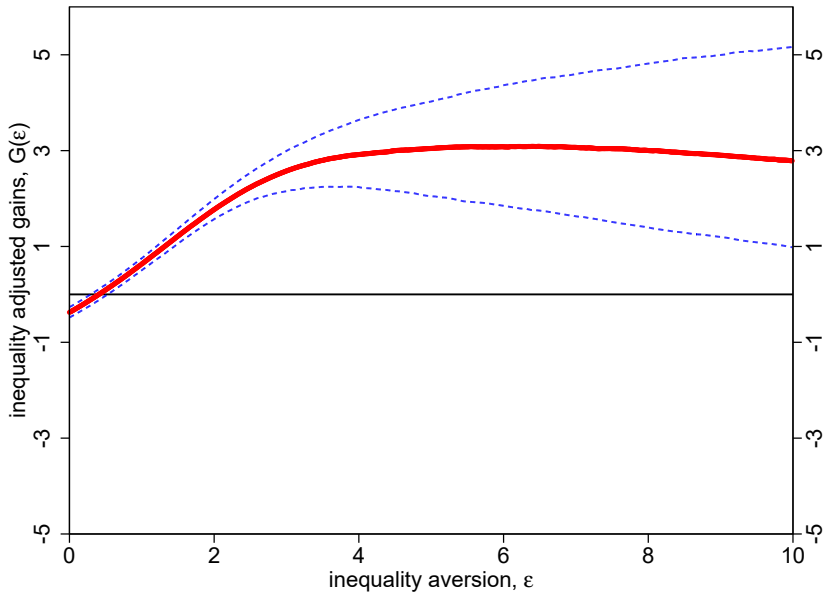
(a) Benin



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure 7
Trade-off with Trade Policy Preference Reversal
Income Losses and Equality Gains

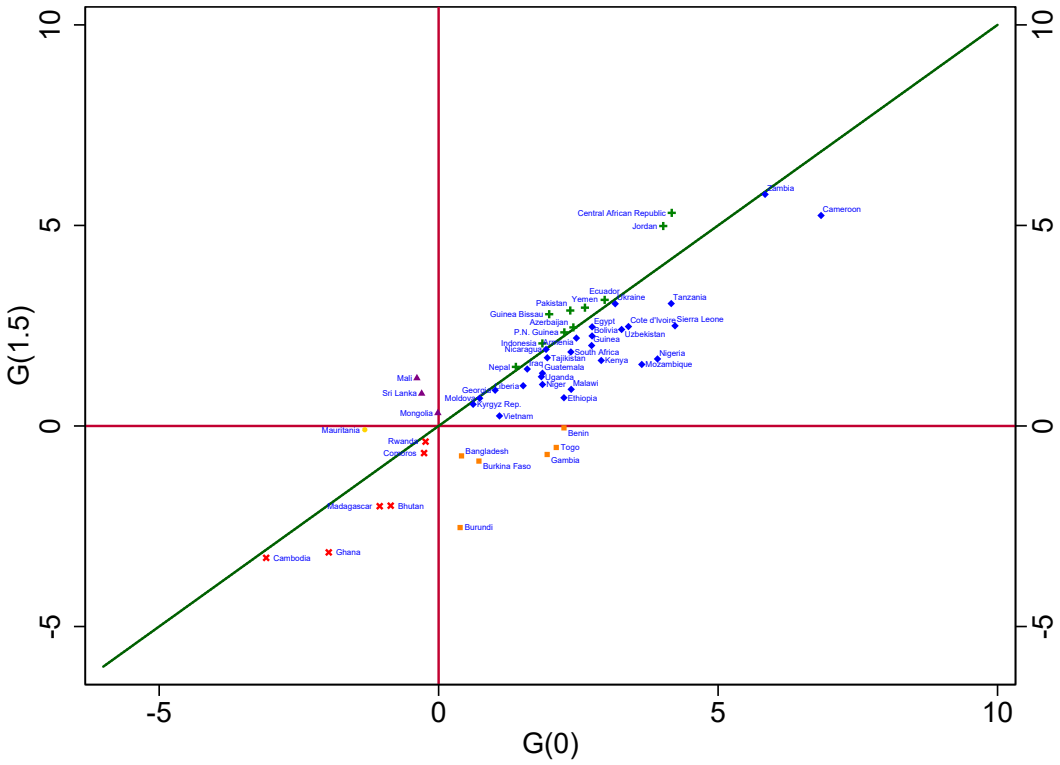
(a) Mali



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure 8
Trade-Off Resolution

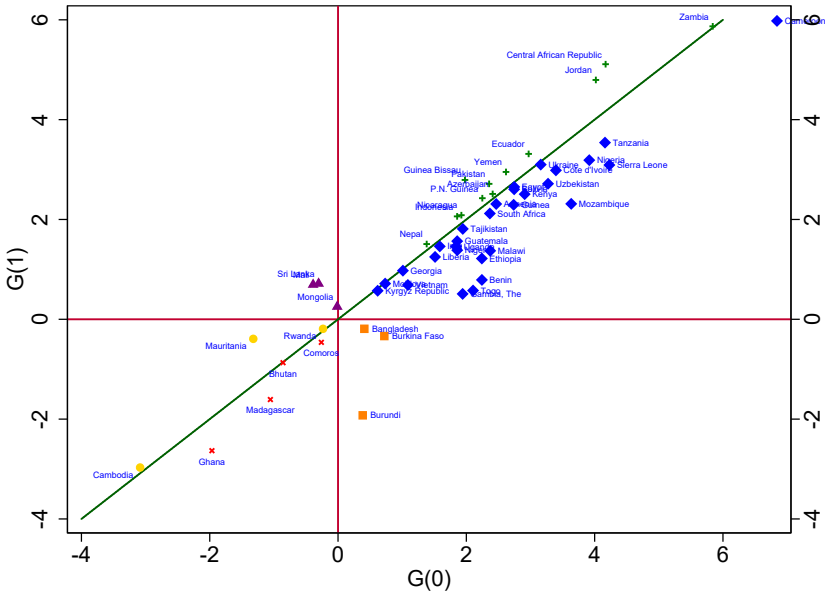
(a) $\varepsilon = 1.5$



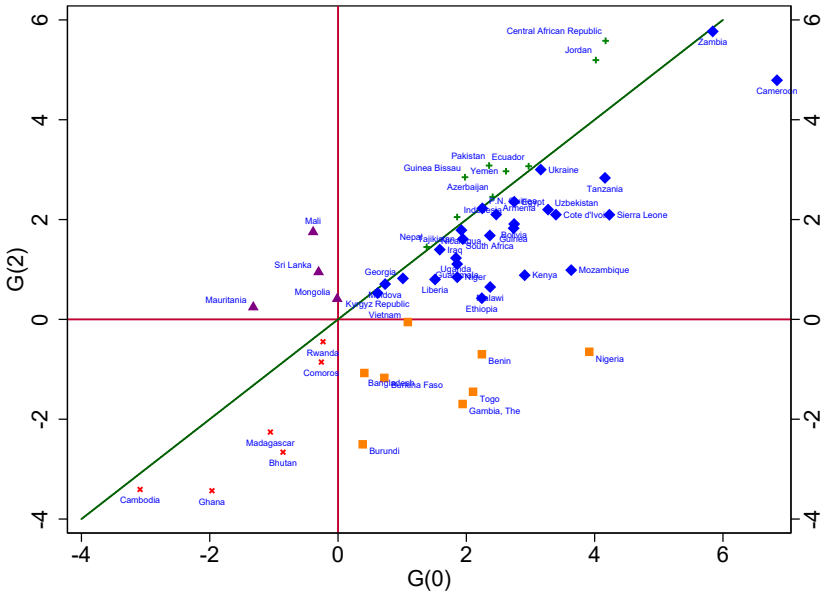
Notes: scatter plot of the inequality-adjusted gains from trade $G(\varepsilon)$, at $\varepsilon = 1.5$, against the gains from trade $G(0)$. The symbols represent the trade-off resolution: ✚: no trade-off, liberalize; ◆: soft trade-off, liberalize; ■: policy reversal, liberalize; ✖: no trade-off, protect; ▲: policy reversal, protect; ●: soft trade-off, protect.

Figure 9
Trade-Off Resolution

(a) $\varepsilon = 1$



(b) $\varepsilon = 2$



Notes: scatter plot of the inequality-adjusted gains from trade $G(\varepsilon)$ against the gains from trade $G(0)$, for $\varepsilon = 1$ (panel a) and $\varepsilon = 2$ (panel b). The symbols represent the trade-off resolution: ✚: no trade-off, liberalize; ◆: soft trade-off, liberalize; ■: policy reversal, liberalize; ✖: no trade-off, protect; ▲: policy reversal, protect; ●: soft trade-off, protect.

Table 1
Average Tariffs

Country	Staple Agric.	Non-Staple Agric.	Manufactures
Benin	12.2	16.9	10.8
Burkina Faso	12.0	18.3	9.3
Burundi	23.8	21.6	10.8
Cameroon	13.8	22.5	23.0
Central African Rep.	16.6	23.7	21.8
Comoros	1.8	10.4	8.9
Côte d'Ivoire	10.4	10.2	9.2
Egypt	7.1	28.0	18.0
Ethiopia	10.1	13.3	12.4
The Gambia	6.6	13.5	13.9
Ghana	16.4	11.6	14.3
Guinea	13.9	18.9	9.5
Guinea Bissau	13.5	15.7	12.8
Kenya	18.7	25.1	11.0
Liberia	6.3	5.6	16.4
Madagascar	8.3	9.6	14.8
Malawi	8.2	22.0	9.3
Mali	11.2	16.8	8.8
Mauritania	9.2	14.8	15.9
Mozambique	8.8	13.9	7.4
Niger	12.2	17.6	9.3
Nigeria	11.3	19.8	11.0
Rwanda	21.0	30.1	11.0
Sierra Leone	11.8	16.2	9.7
South Africa	7.1	6.4	16.8
Tanzania	12.6	29.1	10.7
Togo	11.6	18.6	9.5
Uganda	11.4	29.7	10.0
Zambia	17.1	19.7	6.8

Country	Staple Agric.	Non-Staple Agric.	Manufactures
Armenia	6.9	7.3	6.7
Bangladesh	7.4	4.9	18.8
Bhutan	43.7	46.1	23.5
Cambodia	13.0	6.4	10.1
Indonesia	6.0	1.9	6.1
Iraq	5.0	5.0	5.0
Jordan	7.9	18.6	8.3
Kyrgyz Republic	6.1	6.1	4.0
Mongolia	5.3	6.5	4.9
Nepal	9.0	11.7	13.9
Pakistan	3.7	8.1	17.4
Papua New Guinea	4.7	12.4	0.9
Sri Lanka	7.8	16.3	15.3
Tajikistan	7.4	5.8	8.3
Uzbekistan	14.8	11.4	8.5
Vietnam	11.1	6.3	9.8
Yemen	4.4	7.6	7.7
Azerbaijan	5.7	4.0	10.4
Georgia	6.0	6.4	0.5
Moldova	7.9	10.7	3.3
Ukraine	4.8	5.1	4.8
Bolivia	11.0	12.6	15.1
Ecuador	10.3	10.2	7.4
Guatemala	14.4	15.4	14.0
Nicaragua	12.1	9.8	9.1
Average	10.8	14.4	10.9

Notes: Authors' calculations based on United Nations COMTRADE and UNCTAD TRAINS data. The average tariff is expressed in percentage points.

Table 2
Expenditure Shares

Country	Staple Agric.	Non-Staple Agric.	Manuf.	Non-Traded	Other Cons.	Home
Benin	34.4	3.8	23.3	10.7	6.1	21.6
Burkina Faso	24.4	12.3	16.1	8.8	8.3	30.1
Burundi	41.8	9.9	20.2	12.7	10.8	4.6
Cameroon	46.8	6.1	17.1	14.7	5.9	9.4
C. Africa Rep.	40.4	18.5	21.3	7.9	0.2	11.7
Comoros	48.1	9.5	10.8	17.4	5.1	9.2
Côte d'Ivoire	35.7	3.9	22.2	20.5	6.5	11.3
Egypt	45.5	4.9	13.8	31.4	2.0	2.4
Ethiopia	23.1	9.1	17.0	2.9	10.1	37.7
The Gambia	45.3	11.5	11.3	12.0	10.4	9.6
Ghana	7.7	1.4	30.8	33.0	15.5	11.5
Guinea	33.0	11.9	18.3	12.6	5.0	19.2
Guinea Bissau	50.7	6.3	6.6	7.4	4.2	24.7
Kenya	30.2	9.7	23.4	24.9	2.4	9.4
Liberia	47.1	7.2	12.4	15.2	2.5	15.6
Madagascar	37.2	7.2	12.0	3.6	0.7	39.4
Malawi	25.8	5.7	29.1	6.9	0.7	31.8
Mali	25.6	7.6	4.2	4.9	0.5	57.1
Mauritania	47.2	11.5	14.6	6.7	0.7	19.3
Mozambique	44.7	5.3	14.7	3.9	1.5	29.9
Niger	35.7	8.8	17.1	6.5	10.2	21.7
Nigeria	47.9	3.6	18.0	9.4	0.5	20.6
Rwanda	24.3	4.9	10.6	9.0	29.0	22.1
Sierra Leone	46.2	10.4	12.4	10.8	4.4	15.8
South Africa	31.6	8.3	31.8	16.4	11.8	0.1
Tanzania	29.4	6.6	19.1	9.9	6.2	28.8
Togo	39.0	7.8	15.1	26.2	5.8	6.1
Uganda	24.2	7.6	16.4	17.9	2.0	31.9
Zambia	53.5	4.8	6.3	10.1	0.6	21.8

Country	Staple Agric.	Non-Staple Agric.	Manuf.	Non-Traded	Other Cons.	Home
Armenia	55.5	8.0	7.1	21.2	0.0	8.2
Bangladesh	45.3	9.0	14.1	16.2	4.4	11.0
Bhutan	26.9	7.2	25.5	15.8	12.4	12.3
Cambodia	31.2	12.4	16.0	18.8	8.5	13.0
Indonesia	29.3	11.7	11.4	22.8	13.5	11.3
Iraq	32.3	5.2	35.2	23.0	3.4	0.8
Jordan	35.1	15.2	19.1	29.1	1.2	0.2
Kyrgyz Republic	42.3	5.5	25.5	13.6	3.4	9.7
Mongolia	47.6	8.9	14.3	8.8	1.1	19.3
Nepal	27.3	4.8	11.7	27.6	4.7	23.9
Pakistan	28.2	7.7	23.4	12.9	6.6	21.3
Papua New Guinea	36.2	12.2	5.8	5.0	13.7	27.1
Sri Lanka	32.6	10.2	9.4	19.4	21.7	6.7
Tajikistan	37.8	5.5	24.8	14.8	3.2	13.9
Uzbekistan	36.5	5.1	7.5	10.5	1.9	38.5
Vietnam	37.3	6.5	19.6	15.3	10.6	10.7
Yemen	39.2	20.4	17.5	15.5	4.4	3.1
Azerbaijan	51.1	5.9	20.9	11.6	1.6	9.0
Georgia	34.1	7.8	23.7	27.6	4.7	2.1
Moldova	16.4	2.2	32.1	15.3	7.0	27.1
Ukraine	44.8	11.4	20.0	16.3	0.1	7.4
Bolivia	44.0	7.7	16.8	23.9	1.3	6.4
Ecuador	42.2	3.9	16.8	21.5	8.5	7.2
Guatemala	37.7	5.3	19.8	17.8	4.8	14.6
Nicaragua	40.8	4.9	16.6	19.1	1.0	17.7
Average	37.0	8.0	17.4	15.1	5.8	16.6

Notes: Authors' calculations based on household survey data. The average expenditure shares are expressed in percentage points.

Table 3
Income Shares

Country	Staple Agric.	Non-Staple Agric.	Wages	Family Enterp.	Other	Home Cons.
Benin	14.2	10.0	13.1	0.0	40.9	21.8
Burkina Faso	19.3	2.9	13.6	17.8	12.1	34.2
Burundi	39.5	29.4	8.1	7.5	11.0	4.5
Cameroon	15.4	0.1	27.3	23.1	0.0	34.1
C. African Rep.	42.5	9.3	2.4	3.4	4.3	38.1
Comoros	24.3	3.7	26.8	16.4	10.8	17.9
Côte d'Ivoire	7.1	13.7	16.8	28.4	15.8	18.2
Egypt	6.9	6.9	41.1	15.1	29.8	0.2
Ethiopia	14.3	0.5	5.2	24.3	10.9	44.8
The Gambia	2.7	6.8	46.8	22.1	7.2	14.3
Ghana	8.5	5.5	58.5	0.0	12.0	15.6
Guinea	17.5	3.2	7.0	18.2	13.5	40.5
Guinea Bissau	5.5	21.9	21.7	7.8	10.4	32.8
Kenya	21.8	3.1	35.4	5.3	17.8	16.6
Liberia	10.2	3.4	22.2	29.2	9.9	25.1
Madagascar	27.1	3.0	23.0	13.1	5.1	28.8
Malawi	18.4	4.6	21.4	12.7	3.8	39.0
Mali	8.7	2.8	8.3	10.5	15.4	54.3
Mauritania	13.4	0.0	3.7	10.1	30.8	42.0
Mozambique	10.4	7.1	15.1	10.4	10.0	46.9
Niger	17.3	3.1	4.0	1.5	38.2	35.9
Nigeria	11.6	5.7	41.6	12.8	3.9	24.3
Rwanda	10.5	3.7	24.9	5.7	11.8	46.8
Sierra Leone	18.7	4.6	11.0	13.3	19.6	32.7
South Africa	0.6	0.0	54.9	0.0	43.6	0.8
Tanzania	10.9	3.0	23.0	5.5	11.6	46.0
Togo	8.7	6.5	30.2	37.2	9.7	7.7
Uganda	9.7	2.9	21.6	18.7	13.9	33.1
Zambia	5.7	1.7	20.7	13.1	18.4	39.0

Country	Staple Agric.	Non-Staple Agric.	Wages	Family Enterp.	Other	Home Cons.
Armenia	9.2	0.1	35.1	6.5	40.6	8.5
Bangladesh	33.0	2.1	31.4	14.3	12.1	7.1
Bhutan	12.9	0.0	44.2	9.3	8.6	25.1
Cambodia	24.2	0.5	30.8	23.6	5.3	15.6
Indonesia	4.6	1.2	38.2	0.6	20.9	34.4
Iraq	8.1	1.6	49.2	11.9	28.4	0.8
Jordan	1.7	2.1	45.2	8.9	41.0	1.0
Kyrgyz Rep.	12.2	1.4	40.4	12.0	27.4	6.6
Mongolia	10.1	0.3	38.1	8.7	31.6	11.1
Nepal	4.1	1.2	25.8	10.9	22.1	35.8
Pakistan	7.6	3.1	45.9	12.1	13.8	17.5
P.N. Guinea	13.8	6.5	14.8	9.6	17.9	37.2
Sri Lanka	13.1	4.6	48.8	19.3	0.0	14.2
Tajikistan	0.9	1.5	38.7	8.5	22.4	28.0
Uzbekistan	7.4	0.2	20.3	11.2	20.7	40.2
Vietnam	21.1	3.5	35.3	19.6	13.1	7.4
Yemen	7.8	9.2	43.7	15.3	21.2	2.8
Azerbaijan	28.8	1.9	26.1	2.9	26.2	14.1
Georgia	7.3	1.9	29.2	7.8	51.9	1.9
Moldova	5.5	2.1	30.4	1.7	26.3	33.9
Ukraine	2.8	0.0	43.5	0.1	48.0	5.6
Bolivia	6.3	7.6	36.1	27.3	16.2	6.5
Ecuador	10.6	1.1	48.4	16.7	17.3	5.8
Guatemala	6.4	2.9	45.2	18.0	14.1	13.4
Nicaragua	10.9	2.8	40.4	18.4	13.5	14.0
Average	12.8	4.2	29.2	12.6	18.6	22.7

Notes: Authors' calculations based on household survey data. The average income shares are expressed in percentage points.

Table 4
Gains from Trade - Winners

	Gains	Expenditure			Income				
		agric.	manuf.	total	agric.	wage	enter.	rev.	total
Cameroon	6.8	8.9	3.6	12.5	-1.7	-1.3	-0.7	-1.9	-5.6
Zambia	5.8	7.8	1.2	9.0	-1.1	-0.5	-0.7	-0.8	-3.1
Sierra Leone	4.2	5.8	1.7	7.4	-1.6	-0.1	-0.1	-1.5	-3.2
Central Africa Republic	4.2	7.1	3.7	10.8	-4.5	-0.0	0.0	-2.1	-6.6
Tanzania	4.2	4.7	4.1	8.8	-1.7	-1.1	-0.2	-1.7	-4.6
Jordan	4.0	6.2	2.1	8.3	-0.4	-0.4	-0.1	-3.4	-4.3
Nigeria	3.9	6.1	2.2	8.3	-1.0	-1.9	-0.2	-1.3	-4.4
Mozambique	3.6	6.0	1.2	7.2	-1.1	-0.3	-0.1	-2.0	-3.6
Cote d'Ivoire	3.4	4.6	2.6	7.2	-1.7	-0.6	-0.4	-1.1	-3.8
Uzbekistan	3.3	5.0	1.9	7.0	-0.9	-1.1	-0.4	-1.2	-3.7
Ukraine	3.2	3.7	0.9	4.6	-0.2	-0.2	-0.0	-0.9	-1.4
Ecuador	3.0	5.9	1.5	7.3	-1.6	-1.4	-0.3	-1.0	-4.4
Kenya	2.9	6.1	2.5	8.6	-2.8	-1.2	-0.1	-1.6	-5.7
Ethiopia	2.7	4.7	1.9	6.6	-1.4	-1.1	-0.4	-1.0	-3.8
Bolivia	2.7	4.2	2.3	6.5	-1.2	-0.6	-0.6	-1.3	-3.8
Guinea	2.7	4.9	2.9	7.8	-2.0	-0.1	-0.2	-2.9	-5.1
Yemen	2.6	4.1	1.3	5.4	-0.8	-0.4	-0.1	-1.5	-2.8
Armenia	2.5	3.8	0.4	4.1	-0.5	-0.3	-0.0	-0.9	-1.7
Azerbaijan	2.4	3.9	2.3	6.2	-2.4	-0.1	0.0	-1.3	-3.8
Malawi	2.4	4.1	2.8	6.9	-2.4	-0.6	-0.3	-1.2	-4.5
South Africa	2.4	1.2	2.9	4.2	-0.1	-1.0	0.0	-0.7	-1.8
Pakistan	2.4	2.0	3.7	5.7	-1.4	-0.8	-0.3	-0.8	-3.3
Papua New Guinea	2.2	4.3	0.4	4.7	-2.3	-0.2	-0.0	0.0	-2.5
Benin	2.2	4.8	2.9	7.7	-2.0	-0.2	0.0	-3.2	-5.5
Egypt	2.2	3.7	3.6	7.3	-2.9	-0.0	-0.7	-1.4	-5.1
Togo	2.1	5.3	1.8	7.1	-0.9	-1.0	-0.9	-2.3	-5.0
Guinea Bissau	2.0	4.7	0.8	5.5	-0.9	-0.3	-0.0	-2.3	-3.6
Tajikistan	1.9	3.3	1.4	4.7	-0.2	-0.6	-0.0	-2.0	-2.8
Gambia	1.9	6.5	1.5	8.0	-0.7	-1.1	-0.6	-3.7	-6.0
Nicaragua	1.9	5.0	1.1	6.1	-1.7	-0.9	-0.3	-1.3	-4.2
Niger	1.9	4.3	2.0	6.3	-2.5	-0.0	-0.0	-1.9	-4.4
Guatemala	1.9	3.6	1.2	4.8	-0.8	-1.0	-0.2	-0.9	-2.9
Indonesia	1.9	2.8	0.5	3.2	-0.2	-0.6	-0.0	-0.6	-1.4
Uganda	1.8	5.4	1.1	6.6	-2.2	-1.0	-0.3	-1.4	-4.7
Iraq	1.6	1.5	2.0	3.5	-0.4	-0.3	-0.1	-1.2	-1.9
Liberia	1.5	3.3	1.3	4.6	-0.8	-0.4	-0.5	-1.3	-3.1
Nepal	1.4	2.7	1.6	4.4	-0.5	-0.3	-0.1	-2.0	-3.0
Vietnam	1.1	5.1	2.0	7.1	-2.8	-1.0	-0.4	-1.8	-6.0
Georgia	1.0	2.1	0.1	2.2	-0.6	-0.0	-0.0	-0.6	-1.2
Moldova	0.7	1.4	1.5	2.9	-0.6	-0.1	-0.0	-1.4	-2.1
Burkina Faso	0.7	3.8	2.3	6.1	-2.5	-0.6	-0.5	-1.9	-5.4
Kyrgyz Republic	0.6	1.8	1.4	3.2	-0.7	-0.2	-0.0	-1.6	-2.6
Bangladesh	0.4	4.9	2.3	7.2	-3.9	-1.5	-0.1	-1.3	-6.8
Burundi	0.4	6.9	2.2	9.0	-6.2	-0.5	-0.0	-1.8	-8.6
Average	2.5	4.5	1.9	6.4	-1.6	-0.6	-0.2	-1.5	-3.9

Notes: Authors' calculations. The gain from trade, expressed in percentage points, is the population weighted average of the proportional change in household real expenditure.

Table 5
Gains from Trade - Losers

	Gains	Expenditure			Income				
		agric.	manuf.	total	agric.	wage	enter.	rev.	total
Cambodia	-3.1	4.4	0.9	5.4	-4.5	-0.8	0.0	-3.1	-8.4
Ghana	-2.0	1.0	2.9	3.9	-1.2	-2.8	0.0	-1.8	-5.9
Mauritania	-1.3	4.5	1.8	6.3	-1.1	-0.1	-0.0	-6.5	-7.6
Madagascar	-1.1	3.2	0.8	3.9	-2.3	-0.9	-0.1	-1.7	-5.0
Bhutan	-0.9	8.5	5.3	13.8	-3.2	-2.8	0.0	-8.7	-14.7
Mali	-0.4	2.4	0.2	2.6	-1.0	0.0	-0.0	-2.0	-3.0
Sri Lanka	-0.3	3.3	0.8	4.1	-1.4	-1.2	-0.7	-1.0	-4.4
Comoros	-0.3	1.6	1.3	3.0	-0.7	-0.3	-0.3	-2.0	-3.2
Rwanda	-0.2	3.7	1.4	5.1	-2.6	-1.1	-0.0	-1.6	-5.3
Mongolia	-0.0	2.7	0.6	3.4	-0.7	-0.2	-0.1	-2.4	-3.4
Average	-0.9	3.5	1.6	5.1	-1.9	-1.0	-0.1	-3.1	-6.1

Notes: Authors' calculations. The gain from trade, expressed in percentage points, is the population weighted average of the proportional change in household real expenditure.

Table 6
Income Gains and Inequality Costs
without Trade Policy Preference Reversals

	Income Gains $\frac{\mu_1-\mu_0}{\mu_0}$	Equality Gains $\frac{\mu_1}{\mu_0}\frac{I_0(\varepsilon)-I_1(\varepsilon)}{1-I_0(\varepsilon)}$		
		$\varepsilon = 0.5$	$\varepsilon = 2$	$\varepsilon = 7$
A) Countries without Trade-offs				
Guinea Bissau	2.0	0.5	0.9	1.5
Central African Republic	4.2	0.4	1.4	2.1
Jordan	4.0	0.4	1.2	1.0
Yemen	2.6	0.2	0.3	0.3
Comoros	-0.3	-0.1	-0.6	-1.5
Rwanda	-0.2	-0.2	-0.2	-3.0
Madagascar	-1.1	-0.3	-1.2	-2.3
Ghana	-2.0	-0.4	-1.5	-1.9
B) Countries with Trade-offs				
Pakistan	2.4	0.0	0.7	0.5
Indonesia	1.9	0.1	0.2	-0.3
Azerbaijan	2.4	0.0	0.0	-0.3
Moldova	0.7	-0.0	-0.0	0.4
Zambia	5.8	-0.0	-0.1	0.2
Ukraine	3.2	-0.0	-0.2	-0.6
Kyrgyz Republic	0.6	-0.0	-0.1	-0.1
Ukraine	3.2	-0.0	-0.2	-0.6
Egypt	2.7	-0.1	-0.4	-0.9
Tajikistan	1.9	-0.1	-0.3	-0.7
Iraq	1.6	-0.1	-0.2	-0.3
Armenia	2.5	-0.1	-0.4	-0.9
South Africa	2.4	-0.1	-0.7	-1.0
Guinea	2.7	-0.3	-0.9	-0.9
Uganda	1.8	-0.3	-0.6	0.3
Uzbekistan	3.3	-0.3	-1.1	-2.1
Cameroon	6.8	-0.5	-2.1	-4.3
Bhutan	-0.9	-0.1	-1.8	-6.1
Cambodia	-3.1	0.0	-0.3	-0.7

Notes: Authors' calculations. The table presents the decomposition of the inequality-adjusted gains from trade $G(\varepsilon)$. The first column reports the average income gains from trade (the proportional change in real household expenditures). The three remaining columns show the equality gains (due to changes in inequality) for different values of inequality aversion (low, $\varepsilon = 0.5$, moderate, $\varepsilon = 2$, and high, $\varepsilon = 7$). The inequality-adjusted gains from trade is the *sum* of the income gains and the equality gains.

Table 7
Income Gains and Inequality Costs with Trade Policy Preference Reversals

	Trade Policy Preference Reversals			Potential Reversals	
	$\varepsilon*$	Lower Bound	Upper bound	Lower Bound	Upper Bound
A) Countries with Income Gains					
Bangladesh	0.37	0.51	0.64		
Burkina Faso	0.46	0.56	0.65		
Gambia, The	1.06	1.17	1.28		
Togo	1.17	1.23	1.30		
Benin	1.38	1.47	1.56		
Nigeria	1.81	1.87	1.95		
Vietnam	1.72	1.91	2.09		
Kenya	2.34	2.49	2.71		
Ethiopia	2.72	3.06	3.58		
Mozambique	2.88	3.51	8.49		
Guatemala	6.98	5.24	–		
Liberia	3.50	4.42	–		
Papua New Guinea	3.35	4.79	–		
Malawi	4.05	7.06	–		
Sierra Leone				4.01	–
Niger				6.01	–
Nicaragua				6.33	–
Cote d'Ivoire				7.02	–
Georgia				7.09	–
Nepal				8.79	–
Tanzania				8.85	–
Ecuador				9.92	–
B) Countries with Income Losses					
Mongolia	0.05	0	0.24		
Mali	0.43	0.31	0.54		
Mauritania	1.63	1.49	1.80		
C) Countries with multiple (potential) reversals					
<u>Countries with Income Gains</u>					
Burundi	0.10	0	0.21	5.60	7.11
Bolivia	5.81	3.94	–		
	8.78	3.94	–		
<u>Countries with Income Losses</u>					
Sri Lanka	0.30	0.21	0.38		
	8.88	7.13	–		

Notes: Authors' calculations. The table presents estimates of the trade-ε^*, the cut-off value of inequality aversion at which there is a reversal of trade policy preference in terms of social welfare. The standard errors are estimated using bootstrap from the household survey.

Table 8
Decomposing Equality Gains

	Consumption Equality Gains			Income Equality Gains		
	$\varepsilon = 0.5$	$\varepsilon = 2$	$\varepsilon = 7$	$\varepsilon = 0.5$	$\varepsilon = 2$	$\varepsilon = 7$
Kenya	1.0	2.1	0.3	-1.2	-4.3	-9.0
Burundi	0.9	3.2	1.8	-2.6	-6.1	-8.4
Guinea Bissau	0.9	1.9	3.0	-0.4	-1.1	-1.0
Bhutan	0.9	2.1	2.2	-1.0	-4.1	-9.7
Sri Lanka	0.8	2.3	3.0	-0.3	-1.1	-2.4
Mali	0.6	3.1	6.7	-0.2	-1.0	-3.4
Ecuador	0.6	1.7	1.9	-0.4	-1.7	-3.6
Mauritania	0.5	1.7	3.2	-0.1	-0.1	0.5
Jordan	0.4	1.3	1.4	-0.0	-0.1	-0.3
Cambodia	0.4	0.8	0.7	-0.3	-1.1	-1.4
Yemen	0.3	0.9	1.4	-0.2	-0.5	-1.0
Central African Republic	0.3	0.8	0.5	0.1	0.6	1.0
Rwanda	0.3	1.4	1.9	-0.4	-1.6	-5.1
Nicaragua	0.3	0.7	0.5	-0.2	-0.9	-2.2
Bolivia	0.2	0.4	-0.1	-0.3	-1.3	-2.7
Vietnam	0.2	0.5	-0.3	-0.5	-1.7	-2.7
Ghana	0.2	0.8	0.9	-0.6	-2.3	-2.9
Indonesia	0.2	0.6	0.4	-0.1	-0.4	-0.7
Papua New Guinea	0.2	0.5	0.6	-0.1	-0.6	-5.7
Pakistan	0.2	1.1	1.8	-0.2	-0.4	-1.3
Egypt	0.2	0.6	0.9	-0.3	-1.0	-1.8
Nepal	0.2	0.6	1.0	-0.1	-0.6	-1.7
Cameroon	0.2	0.3	0.3	-0.7	-2.5	-5.2
Azerbaijan	0.2	0.5	0.7	-0.1	-0.5	-1.0
Cote d'Ivoire	0.1	0.1	0.5	-0.3	-1.4	-3.0
Guatemala	0.1	0.2	0.1	-0.3	-1.0	-2.0
Mongolia	0.1	0.4	0.8	0.0	0.0	-0.2
Zambia	0.1	0.4	0.7	-0.1	-0.5	-0.6

Notes: The table presents the decomposition of the equality gains from trade $G(\varepsilon)-G(0)$. The first three column report the average consumption equality gains from trade for different values of inequality aversion (low, $\varepsilon = 0.5$, moderate, $\varepsilon = 2$, and high, $\varepsilon = 7$). These consumption equality gains are calculated by assuming that liberalization only impacts consumption and not income. The three remaining columns report the income equality gains from trade for different values of inequality aversion (low, $\varepsilon = 0.5$, moderate, $\varepsilon = 2$, and high, $\varepsilon = 7$), calculated by assuming that liberalization only impacts income but not consumption.

Table 8
Decomposing Equality Gains (Continued)

	Consumption Equality Gains			Income Equality Gains		
	$\varepsilon = 0.5$	$\varepsilon = 2$	$\varepsilon = 7$	$\varepsilon = 0.5$	$\varepsilon = 2$	$\varepsilon = 7$
Togo	0.1	-0.0	-0.7	-0.8	-3.5	-5.3
Tanzania	0.1	0.2	0.4	-0.6	-1.6	-3.4
Comoros	0.1	0.2	-0.2	-0.2	-0.8	-1.3
Georgia	0.0	-0.0	-0.3	-0.0	-0.2	-0.3
Bangladesh	0.0	-0.1	-0.7	-0.4	-1.4	-2.6
Niger	-0.0	-0.2	1.0	-0.3	-0.9	-2.0
Moldova	-0.0	0.0	0.3	-0.0	-0.0	0.1
South Africa	-0.0	-0.7	-1.4	-0.1	-0.0	0.4
Tajikistan	-0.0	-0.1	-0.2	-0.1	-0.2	-0.5
Ukraine	-0.0	-0.1	-0.3	-0.0	-0.1	-0.3
Iraq	-0.0	0.1	0.3	-0.1	-0.3	-0.6
Kyrgyz Republic	-0.0	-0.1	-0.1	-0.0	-0.0	0.0
Gambia, The	-0.0	-0.6	-0.1	-0.6	-3.0	-6.4
Armenia	-0.0	-0.2	-0.9	-0.0	-0.1	0.0
Guinea	-0.1	-0.3	-0.3	-0.2	-0.6	-0.7
Uganda	-0.1	0.1	1.9	-0.2	-0.7	-1.9
Nigeria	-0.1	-2.1	-4.4	-0.2	-2.4	-5.3
Liberia	-0.1	-0.3	-0.4	-0.1	-0.4	-1.5
Madagascar	-0.1	-0.2	0.3	-0.2	-1.0	-2.7
Sierra Leone	-0.1	-0.2	-3.2	-0.6	-2.0	-1.4
Burkina Faso	-0.2	-0.8	-1.1	-0.4	-1.1	-2.5
Ethiopia	-0.3	-0.9	-1.7	-0.4	-1.0	-1.8
Benin	-0.4	-1.4	-3.1	-0.4	-1.5	-3.1
Malawi	-0.4	-1.1	-1.3	-0.2	-0.6	-1.2
Uzbekistan	-0.4	-1.3	-2.4	0.1	0.2	0.2
Mozambique	-0.5	-2.2	-3.5	-0.2	-0.5	-1.6
Average	0.1	0.2	0.3	-0.2	-0.9	-1.7

Notes: The table presents the decomposition of the equality gains from trade $G(\varepsilon)-G(0)$. The first three column report the average consumption equality gains from trade for different values of inequality aversion (low, $\varepsilon = 0.5$, moderate, $\varepsilon = 2$, and high, $\varepsilon = 7$). These consumption equality gains are calculated by assuming that liberalization only impacts consumption and not income. The three remaining columns report the income equality gains from trade for different values of inequality aversion (low, $\varepsilon = 0.5$, moderate, $\varepsilon = 2$, and high, $\varepsilon = 7$), calculated by assuming that liberalization only impacts income but not consumption.

Appendix A: Household Surveys and Data Harmonization

Table A1 displays basic information on the household surveys used in the analysis. We report the name of the survey, the year when the data were collected and sample sizes (number of households). The harmonization of the household surveys and the trade and trade policy data was done in two steps. First, all household surveys product and income sources were standardized to common templates, which are shown in Figures A1-A3 below. Second, these harmonized household survey data were merged with HS6 tariff and trade data using custom-made concordances.

Table A1
Household Surveys

Country	Year	Obs	Survey
Benin	2003	5296	Questionnaire Unifié sur les Indicateurs de Base du Bien-Être
Burkina Faso	2003	8413	Enquête sur les Conditions de Vie des Ménages
Burundi	1998	6585	Enquête Prioritaire, Etude Nationale sur les Conditions de Vie des Populations
Cameroon	2001-2002	10881	Deuxième Enquête Camerounaise Auprès des Ménages
Central African Republic	2008	6828	Enquête Centrafricaine pour le Suivi-Evaluation du Bien-être
Comoros	2004	2929	Enquête Intégrale auprès des Ménages
Côte d'Ivoire	2008	12471	Enquête sur le Niveau de Vie des Ménages
Egypt	2008-2009	23193	Household Income, Expenditure and Consumption Survey
Ethiopia	1999-2000	16505	Household Income, Consumption and Expenditure Survey
The Gambia	1998	1952	Household Poverty Survey
Ghana	2005-2006	8599	Living Standards Survey V
Guinea	2012	7423	Enquête Légère pour l'Evaluation de la Pauvreté
Guinea Bissau	2010	3141	Inquerito Ligeiro para a Avalicão da Pobreza
Kenya	2005	13026	Integrated Household Budget Survey
Liberia	2014-2015	4063	Household Income and Expenditure Survey
Madagascar	2005	11661	Permanent Survey of Households
Malawi	2004-2005	11167	Second Integrated Household Survey
Mali	2006	4449	Enquête Légère Intégrée auprès des Ménages
Mauritania	2004	9272	Enquête Permanente sur les Conditions de Vie des Ménages
Mozambique	2008-2009	10696	Inquérito sobre Oramento Familiar
Niger	2005	6621	Enquête Nationale sur les Conditions de Vie des Ménages
Nigeria	2003-2004	18603	Living Standards Survey
Rwanda	1998	6355	Integrated Household Living Conditions Survey
Sierra Leone	2011	6692	Integrated Household Survey
South Africa	2000	25491	General Household Survey
Tanzania	2008	3232	Household Budget Survey
Togo	2011	5464	Questionnaire des Indicateurs de Base du Bien-être
Uganda	2005-2006	7350	National Household Survey
Zambia	2004	7563	Living Conditions Monitoring Survey IV

Table A1 (Continued)
Household Surveys (Continued)

Country	Year	Obs	Survey
Armenia	2014	5124	Integrated Living Conditions Survey
Bangladesh	2010	12117	Household Income and Expenditure Survey
Bhutan	2012	8879	Living Standards Survey
Cambodia	2013	3801	Socio-Economic Survey
Indonesia	2007	12876	Indonesian Family Life Survey
Iraq	2012	24895	Household Socio-Economic Survey
Jordan	2010	11110	Household Expenditure and Income Survey
Krygyz Republic	2012	4962	Intergrated Sample Household Budget and Labor Survey
Mongolia	2011	11089	Household Socio-Economic Survey
Nepal	2010-2011	5929	Living Standards Survey
Pakistan	2010-2011	16178	Social and Living Standards Measurement Survey
Papua New Guinea	2009	3776	Household Income and Expenditure Survey
Sri Lanka	2012-2013	20335	Household Income and Expenditure Survey
Tajikistan	2009	1488	Tajikistan Panel Survey
Uzbekistan	2003	9419	Household Budget Survey
Vietnam	2012	9306	Household Living Standard Survey
Yemen	2005-2006	12998	Household Budget Survey
Azerbaijan	2005	4797	Household Budget Survey
Georgia	2014	10959	Household Integrated Survey
Moldova	2014	4836	Household Budget Survey
Ukraine	2012	10394	Sampling Survey of the Conditions of Life of Ukraine's Households
Bolivia	2008	3900	Encuesta de Hogares
Ecuador	2013-2014	11420	Encuesta de Condiciones de Vida
Guatemala	2014	28680	Encuesta Nacional de Condiciones de Vida
Nicaragua	2009	6450	Nicaragua - Encuesta Nacional de Hogares sobre Medición de Niveles de Vida

Figure A1
Expenditure Template

Expenditure								
1. Agriculture/Food								
11. Staple Food								
111. Cerals	112. Legumens	113. Fruits	114. Vegetables	115. Oils/Fats	116. Fish	117. Meat/Livestock	118. Dairy/Eggs	119. Other staple food
1111. Corn 1112. Wheat 1113. Rice 1114. Other Cereals	1121. Beans 1122. Other	1131. Banana 1132. Grapes 1133. Citrus 1134. Apples 1135. Other Fruits	1141. Tomato 1142. Potato 1143. Greens 1144. Other Vegetables	1151. Vegetable Oils 1152. Animal Fats 1153. Other oils/fats	1161. Fish 1162. Shrimp 1163. Other Crustacean	1171. Pork (Pig) 1172. Beef (Cattle) 1173. Poultry (Chicken) 1174. Other meat/animals	1181. Milk 1182. Eggs 1183. Cheese 1184. Other Dairy	1191. Other staple food 1192. Other processed food
12. Non Staple								
121. Alcohol	122. Tobacco	123. Oil seeds	124. Spices/herbs		125. Coffee/tea/cocoa	126. Nuts	127. Cotton	128. Other non-staple food
1211. Wine 1212. Beer 1213. Other alcohol	1221. Cigarettes 1222. Other tobacco	1231. Soya 1232. Other oil seeds	1241. Cloves 1242. Pepper 1243. Vanilla 1244. Saffron 1245. Qat (chat) 1246. Other spices		1251. Coffee 1252. Tea 1253. Cocoa	1261. Cashew 1262. Coconut 1263. Other nuts	127. Cotton	1281. Sugar (any kind) 1282. Other non-staple
2. Manufacturing/Household Items								
21. Energy 22. Textiles/Apparel 23. Electric/Electronics 24. Household items/Furniture 25. Other physical goods								
3. Services								
31. Transportation 32. Health 33. Education 34. Communication 35. Other Services								
4. Other Expenditures								
41. Remittances/transfers given 42. Investment of any sort 43. Festivities 44. Other Disbursement								

Figure A2
Auto-Consumption Template

Autoconsumption								
1. Agriculture/Food								
11. Staple Food								
111. Cerals	112. Legumens	113. Fruits	114. Vegetables	115. Oils/Fats	116. Fish	117. Meat/Livestock	118. Dairy/Eggs	119. Other staple food
1111. Corn 1112. Wheat 1113. Rice 1114. Other Cereals	1121. Beans 1122. Other	1131. Banana 1132. Grapes 1133. Citrus 1134. Apples 1135. Other Fruits	1141. Tomato 1142. Potato 1143. Greens 1144. Other Vegetables	1151. Vegetable Oils 1152. Animal Fats 1153. Other oils/fats	1161. Fish 1162. Shrimp 1163. Other Crustacean	1171. Pork (Pig) 1172. Beef (Cattle) 1173. Poultry (Chicken) 1174. Other meat/animals	1181. Milk 1182. Eggs 1183. Cheese 1184. Other Dairy	1191. Other staple food 1192. Other processed food
12. Non Staple								
121. Alcohol	122. Tobacco	123. Oil seeds	124. Spices/herbs		125. Coffee/tea/cocoa	126. Nuts	127. Cotton	128. Other non-staple food
1211. Wine 1212. Beer 1213. Other alcohol	1221. Cigarettes 1222. Other tobacco	1231. Soya 1232. Other oil seeds	1241. Cloves 1242. Pepper 1243. Vanilla 1244. Saffron 1245. Qat (chat) 1246. Other spices		1251. Coffee 1252. Tea 1253. Cocoa	1261. Cashew 1262. Coconut 1263. Other nuts	127. Cotton	1281. Sugar (any kind) 1282. Other non-staple
2. Other goods								
21. Energy (wood, coal) 22. Gathering (forest, mushrooms, berries, etc.) 23. Other goods collected for free 24. Other goods produced and consumed within the household								

Figure A3
Income Template

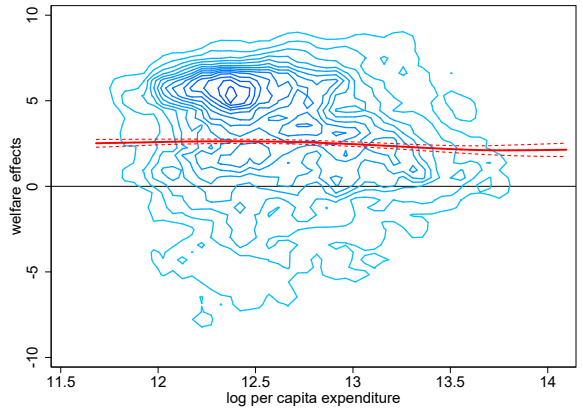
Income								
1. Agriculture/Food								
11. Staple Food								
111. Cerals	112. Legumens	113. Fruits	114. Vegetables	115. Oils/Fats	116. Fish	117. Meat/Livestock	118. Dairy/Eggs	119. Other staple food
1111. Corn 1112. Wheat 1113. Rice 1114. Other Cereals	1121. Beans 1122. Other	1131. Banana 1132. Grapes 1133. Citrus 1134. Apples 1135. Other Fruits	1141. Tomato 1142. Potato 1143. Greens 1144. Other Vegetables	1151. Vegetable Oils 1152. Animal Fats 1153. Other oils/fats	1161. Fish 1162. Shrimp 1163. Other Crustacean	1171. Pork (Pig) 1172. Beef (Cattle) 1173. Poultry (Chicken) 1174. Other meat/animals	1181. Milk 1182. Eggs 1183. Cheese 1184. Other Dairy	1191. Other staple food 1192. Other processed food
12. Non Staple								
121. Alcohol	122. Tobacco	123. Oil seeds	124. Spices/herbs		125. Coffee/tea/cocoa	126. Nuts	127. Cotton	128. Other non-staple food
1211. Wine 1212. Beer 1213. Other alcohol	1221. Cigarettes 1222. Other tobacco	1231. Soya 1232. Other oil seeds	1241. Cloves 1242. Pepper 1243. Vanilla 1244. Saffron 1245. Qat (chat) 1246. Other spices		1251. Coffee 1252. Tea 1253. Cocoa	1261. Cashew 1262. Coconut 1263. Other nuts	127. Cotton	1281. Sugar (any kind) 1282. Other non-staple
2. Wages								
20. Agriculture, forestry, and fishing 21. Mining, oil, and gas extraction 22. Manufacturing 23. Construction 24. Transportation, communications, electric, gas, and sanitary services 25. Wholesale and retail trade 26. Finance, insurance, and real estate 27. Entertainment Services (Restaurant, entertainment, hotels, etc.) 28. Professional Services (Education, health, other professional occupations) 29. Public Administration								
3. Sales of Goods/Services								
31. Mining, oil, and gas extraction 32. Manufacturing 33. Construction 34. Transportation, communications, electric, gas, and sanitary services 35. Wholesale and retail trade 36. Finance, insurance, and real estate 37. Entertainment Services (Restaurant, entertainment, hotels, etc.) 38. Professional Services (Education, health, other professional occupations) 39. Public Administration								
4. Transfers								
41. Remittances/transfers received (friend, relative) 42. Profits of investment (rent, interests) 43. Government transfers 44. Non-governmental transfers 45. Other								

Appendix B: Distributional Effects

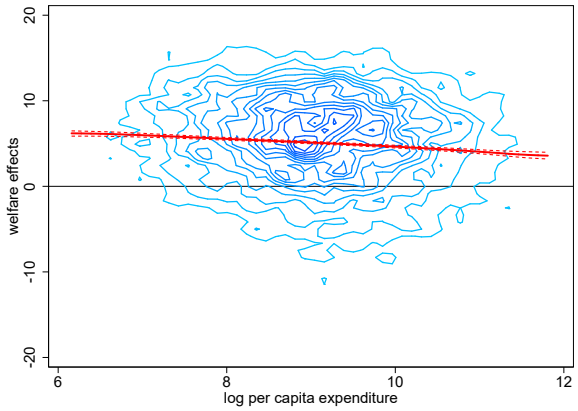
This Appendix includes plots of the distributional effects (kernel regressions and bivariate kernel densities) for each of the 54 countries. We first report 17 cases with a pro-poor bias (Figures B1 to B3), then show another 37 cases with a pro-rich bias (Figures B4 to B10).

Figure B1
Pro-Poor Bias

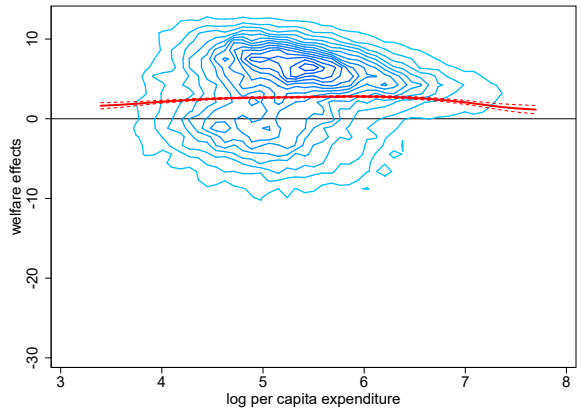
(a) Azerbaijan



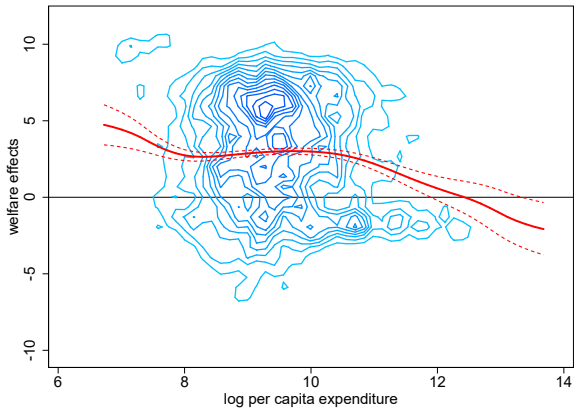
(b) Central African Republic



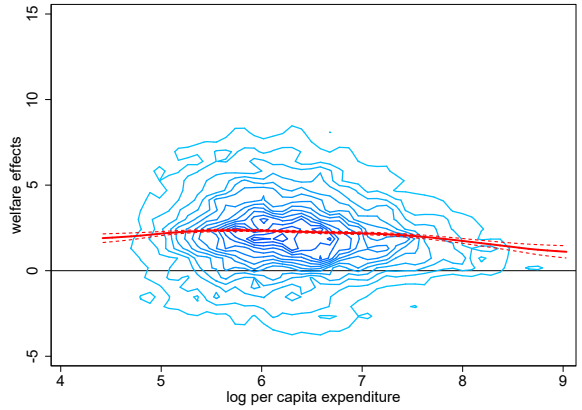
(c) Ecuador



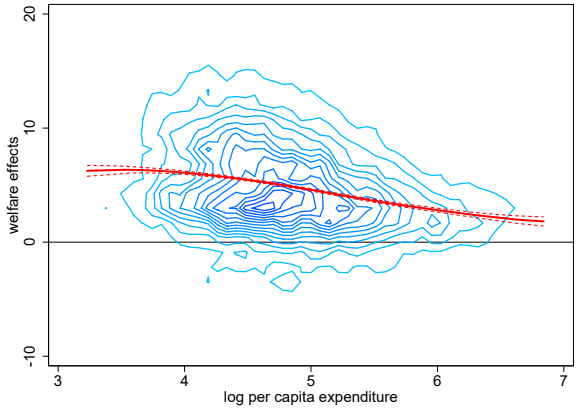
(d) Guinea Bissau



(e) Indonesia

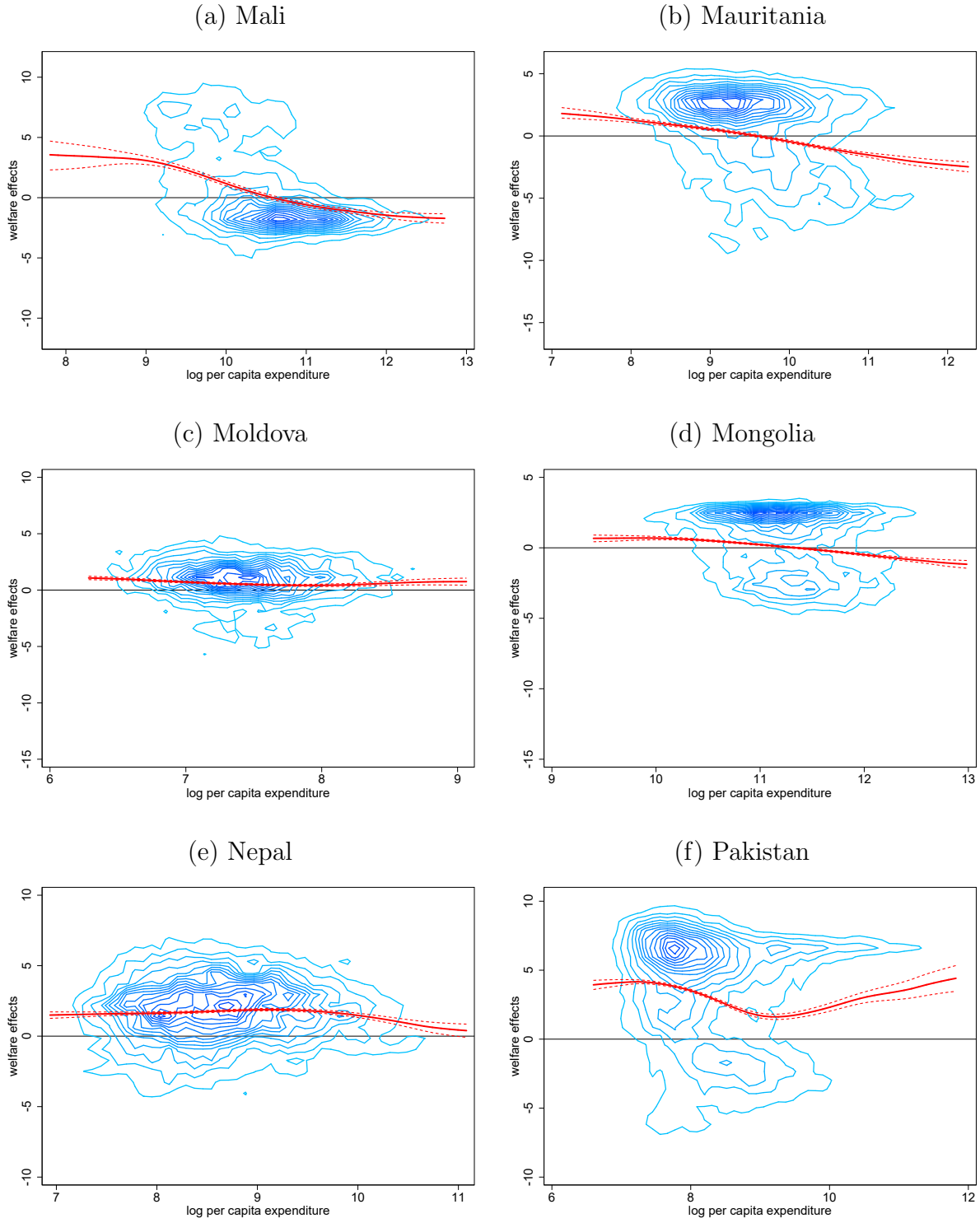


(f) Jordan



Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-poor bias if the average proportional real income gains accruing to households in the the bottom 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the top 20% of the pre-liberalization real income income distribution.

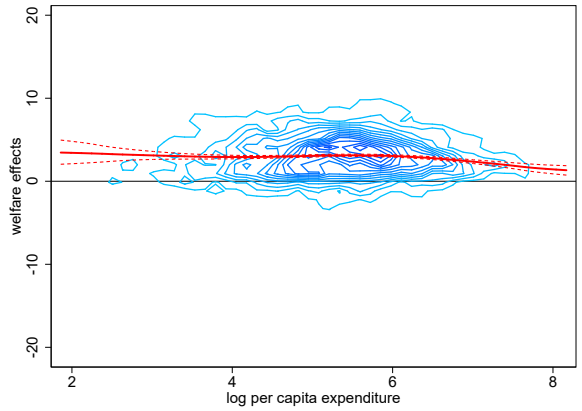
Figure B2
Pro-Poor Bias



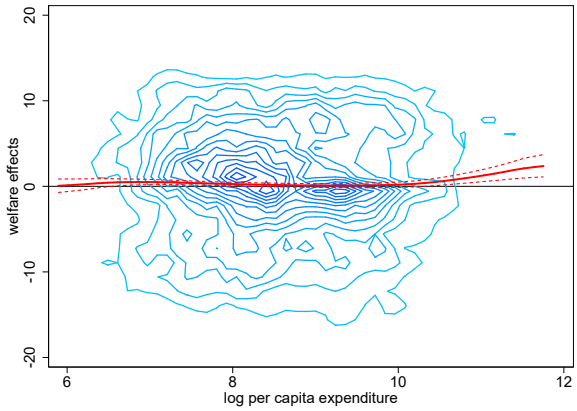
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-poor bias if the average proportional real income gains accruing to households in the the bottom 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the top 20% of the pre-liberalization real income income distribution.

Figure B3
Pro-Poor Bias

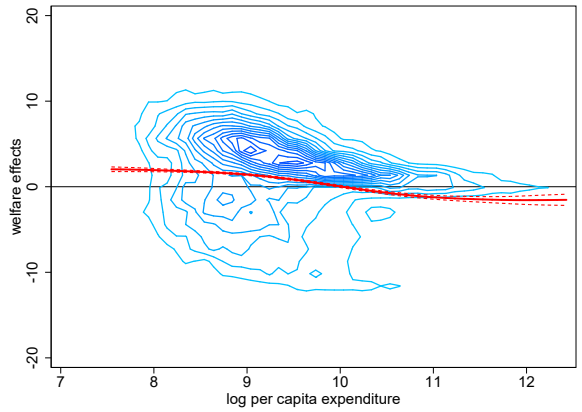
(a) Papua New Guinea



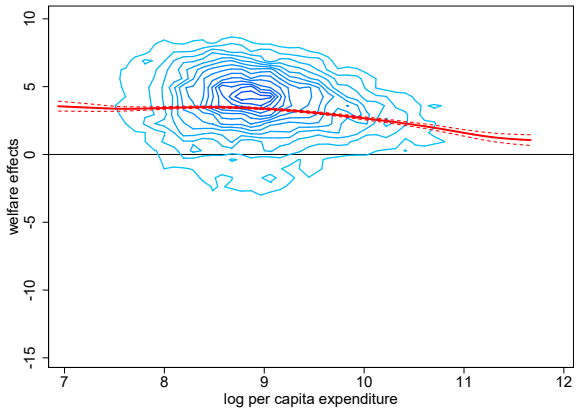
(b) Rwanda



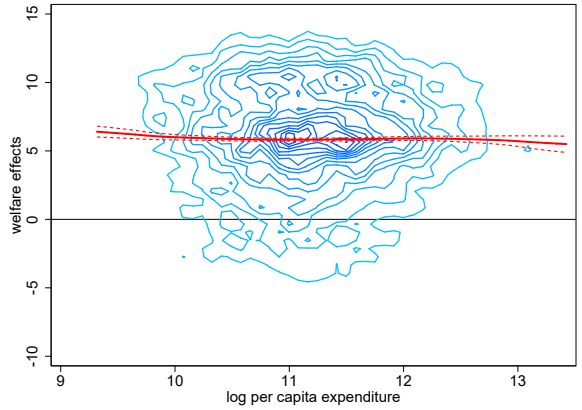
(c) Sri Lanka



(d) Yemen

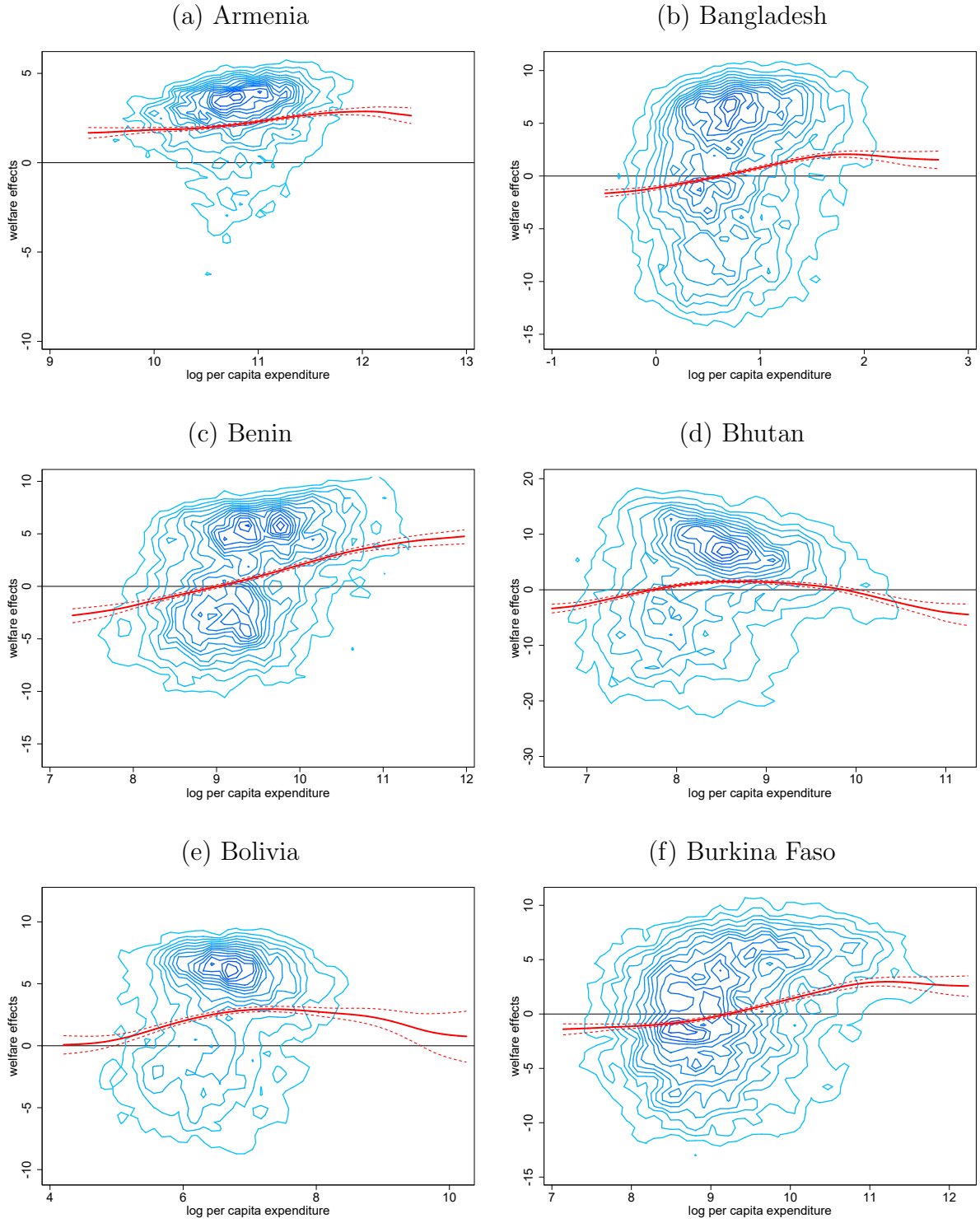


(e) Zambia



Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-poor bias if the average proportional real income gains accruing to households in the the bottom 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the top 20% of the pre-liberalization real income income distribution.

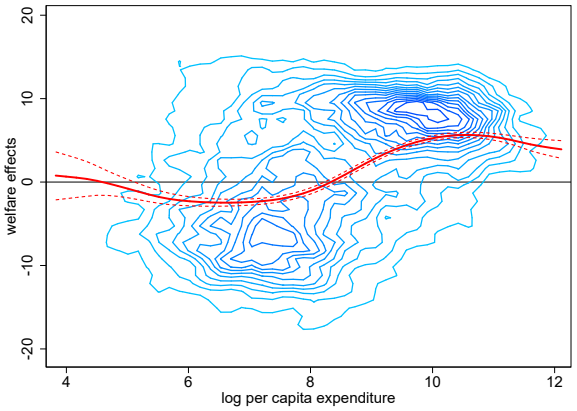
Figure B4
Pro-Rich Bias



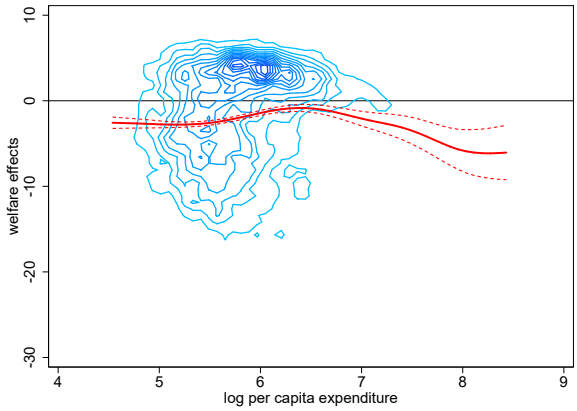
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure B5
Pro-Rich Bias

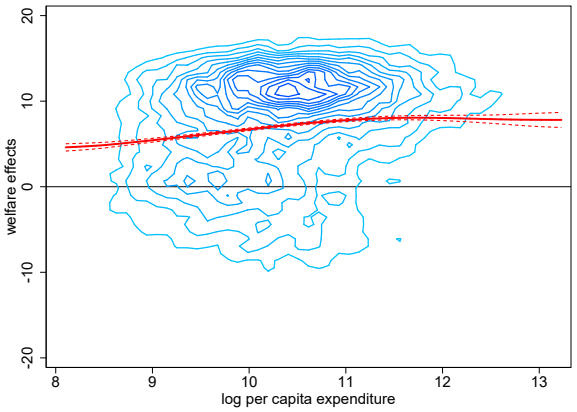
(a) Burundi



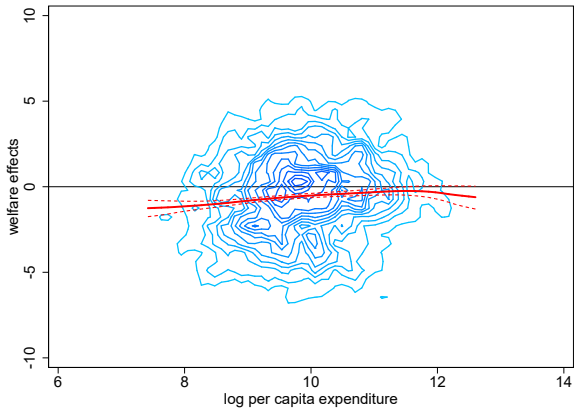
(b) Cambodia



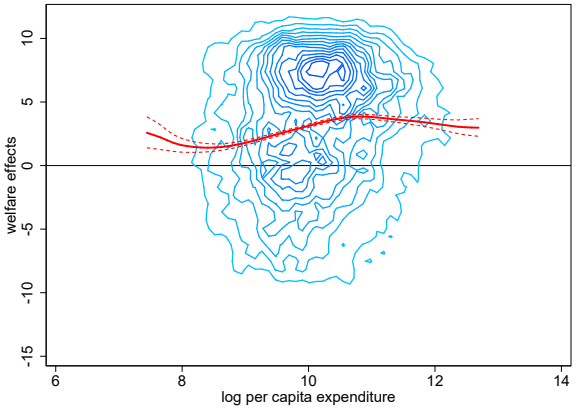
(c) Cameroon



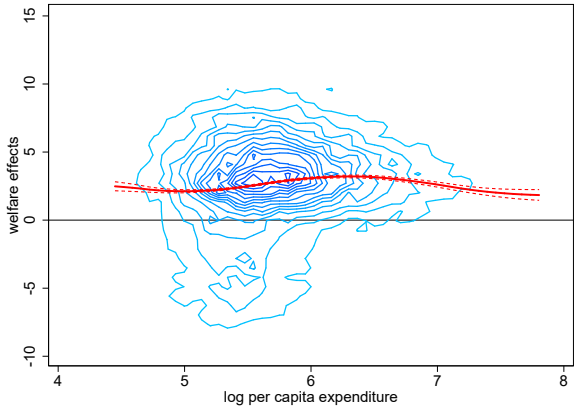
(d) Comoros



(e) Côte d'Ivoire



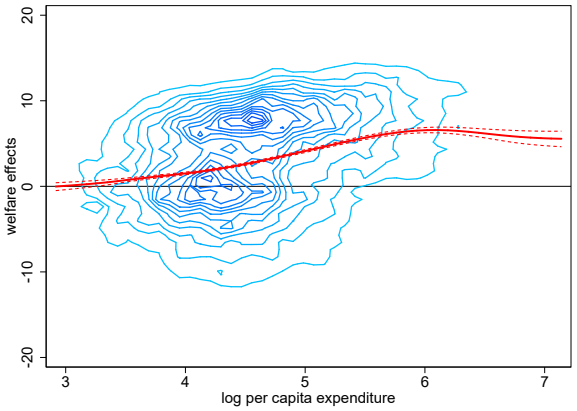
(f) Egypt



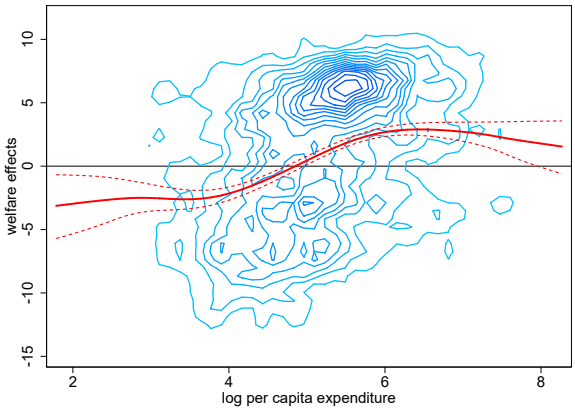
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure B6
Pro-Rich Bias

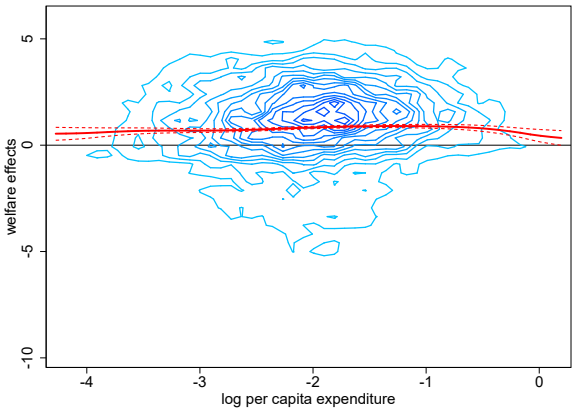
(a) Ethiopia



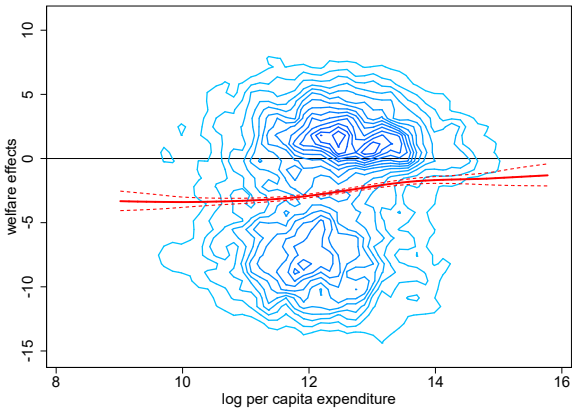
(b) The Gambia



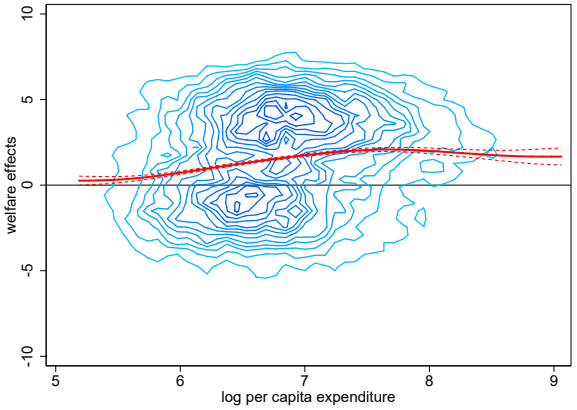
(c) Georgia



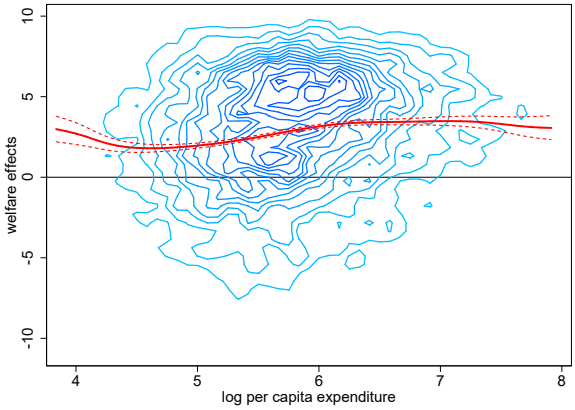
(d) Ghana



(e) Guatemala



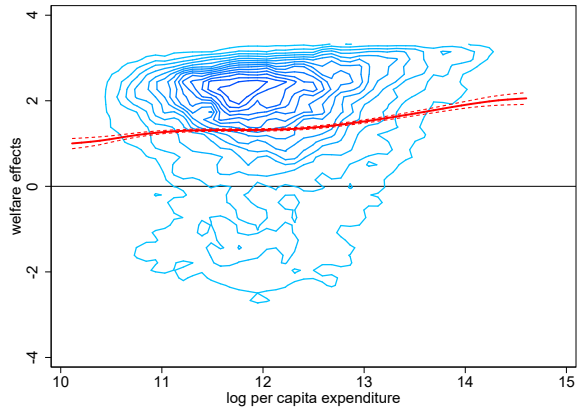
(f) Guinea



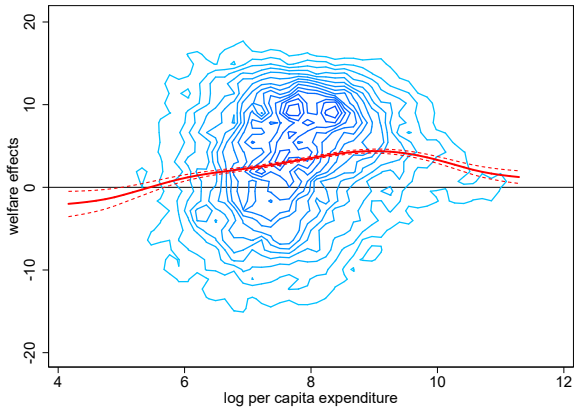
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure B7
Pro-Rich Bias

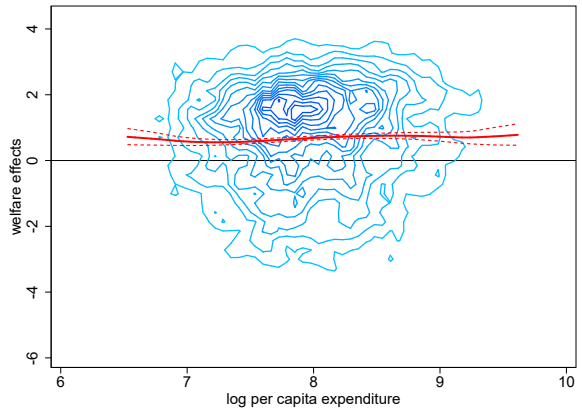
(a) Iraq



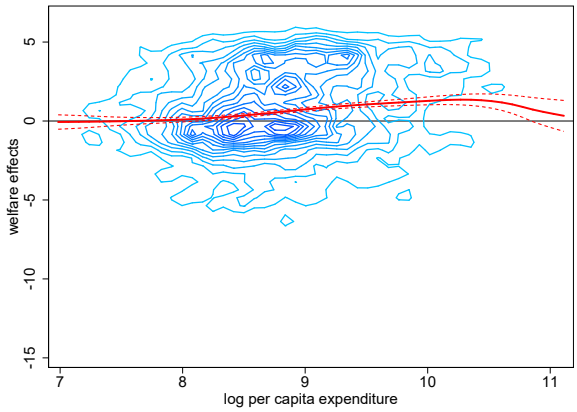
(b) Kenya



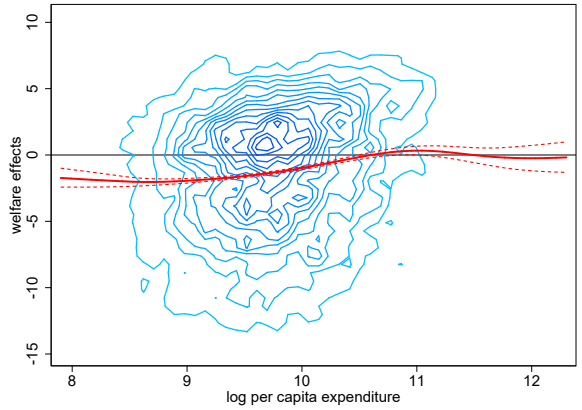
(c) Kygyz Republic



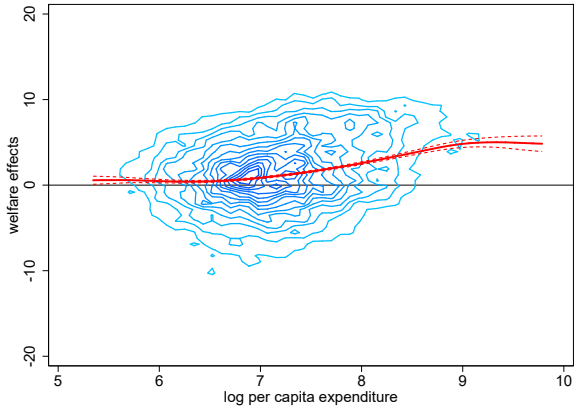
(d) Liberia



(e) Madagascar



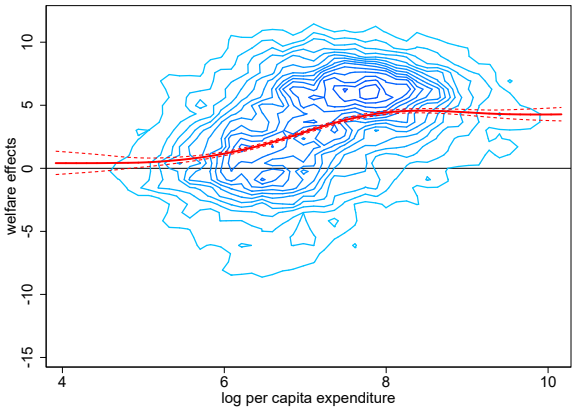
(f) Malawi



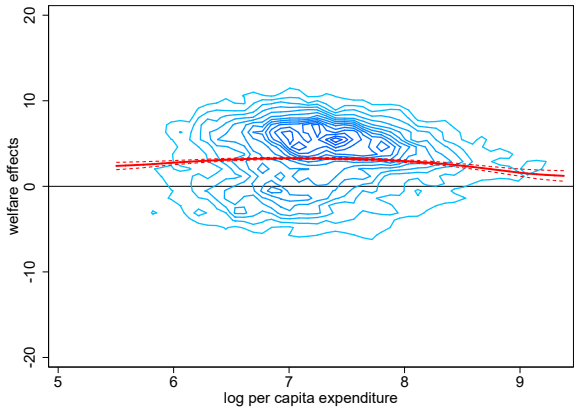
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure B8
Pro-Rich Bias

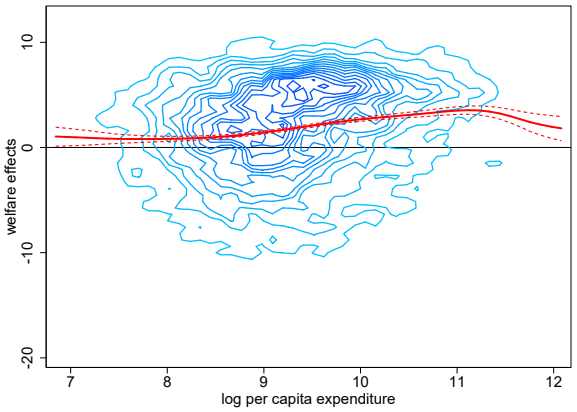
(a) Mozambique



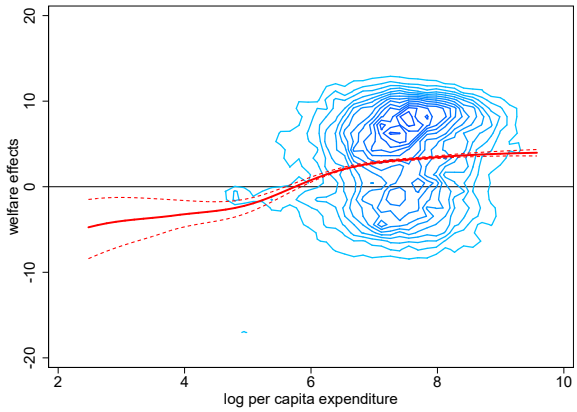
(b) Nicaragua



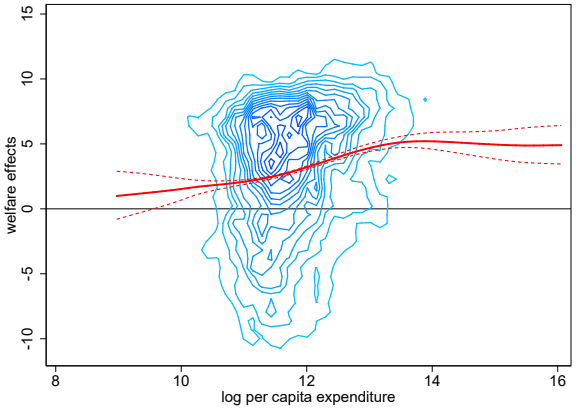
(c) Niger



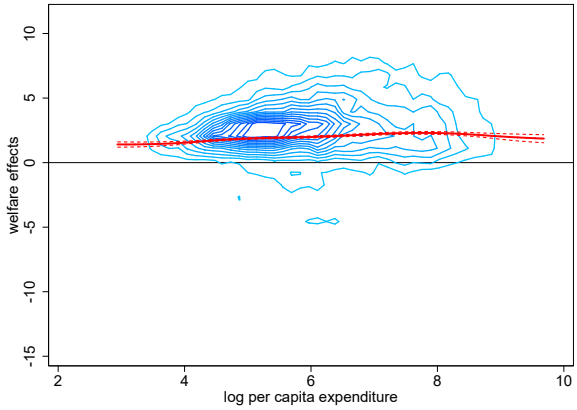
(d) Nigeria



(e) Sierra Leone



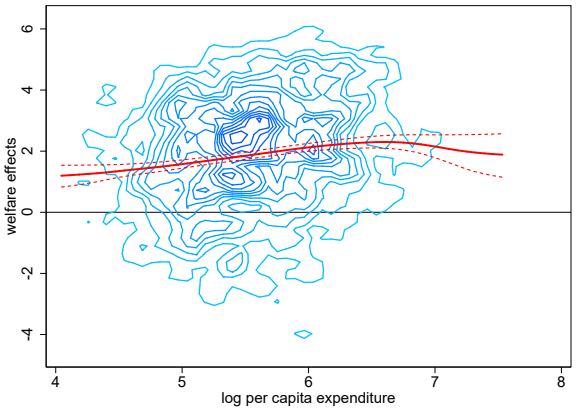
(f) South Africa



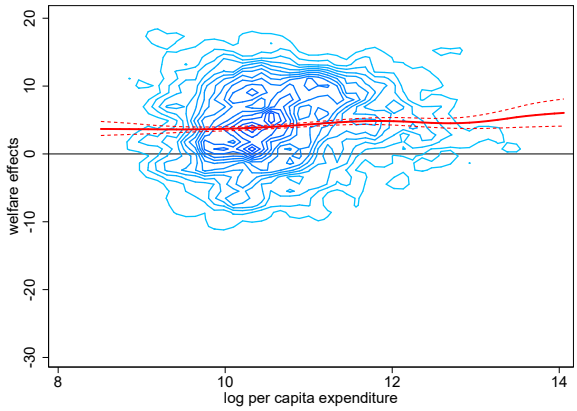
Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure B9
Pro-Rich Bias

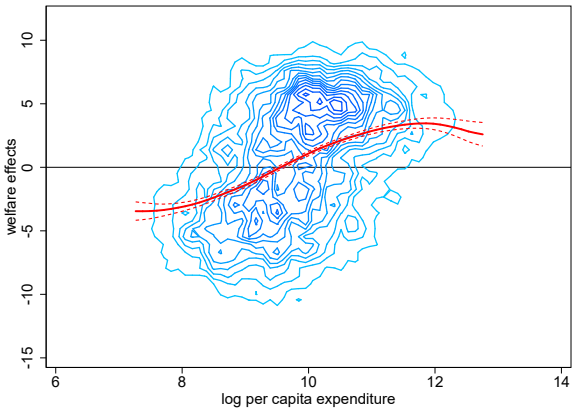
(a) Tajikistan



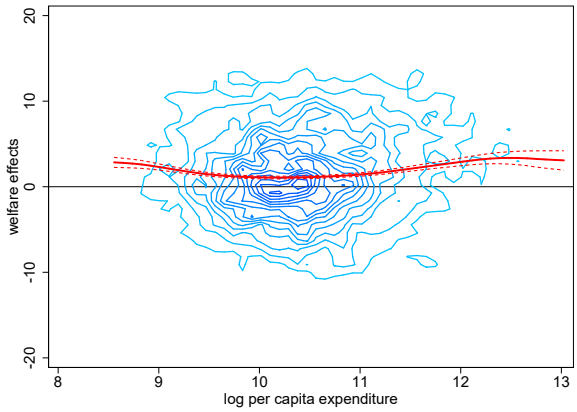
(b) Tanzania



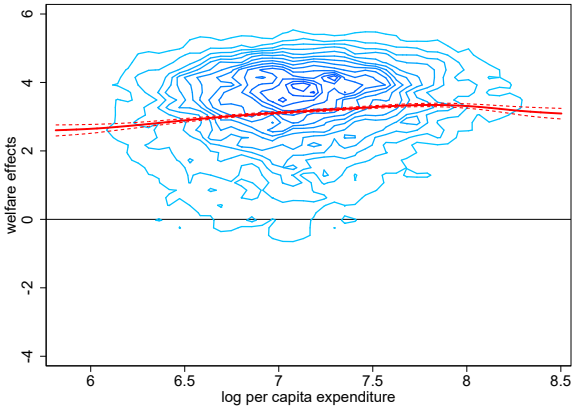
(c) Togo



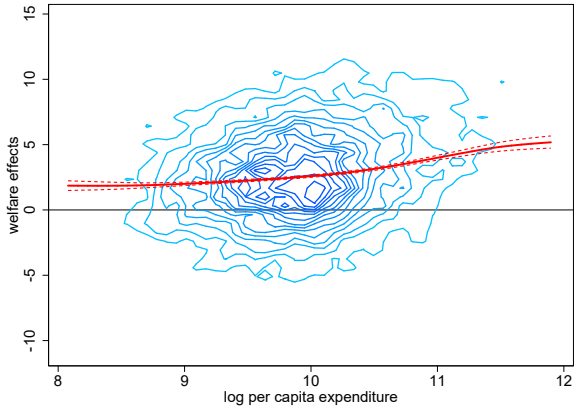
(d) Uganda



(e) Ukraine



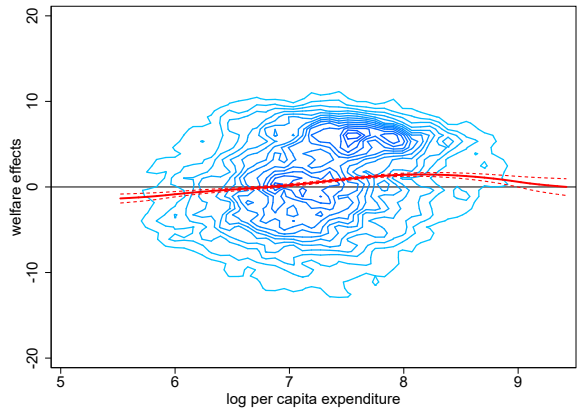
(f) Uzbekistan



Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

Figure B10
Pro-Rich Bias

(a) Vietnam

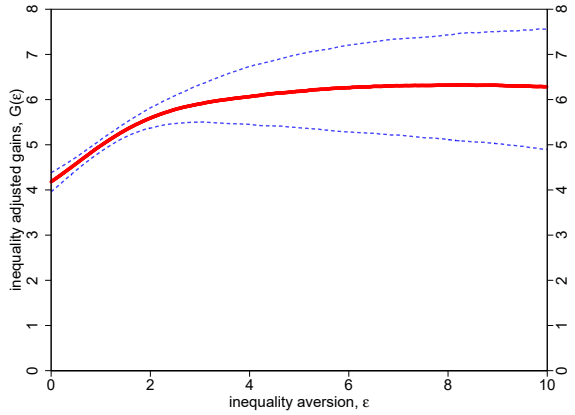


Notes: The red curve is the non-parametric kernel regression of the welfare effects and the initial level of per capita household expenditure. The contour lines are level curves of the non-parametric kernel bivariate density of these two variables. Liberalization is classified as having a pro-rich bias if the average proportional real income gains accruing to households in the the top 20% of the pre-liberalization income distribution exceed the average proportional real income gains accruing to households in the bottom 20% of the pre-liberalization real income income distribution.

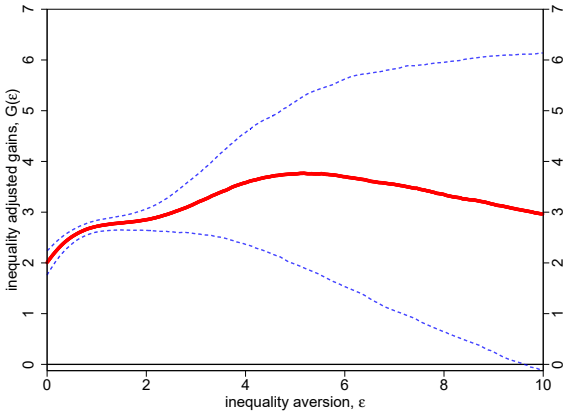
Appendix C: Inequality Adjusted Welfare Gains

Figure C1
No Trade-off
Income Gains and Equality Gains
No Trade Policy Preference Ranking Reversals

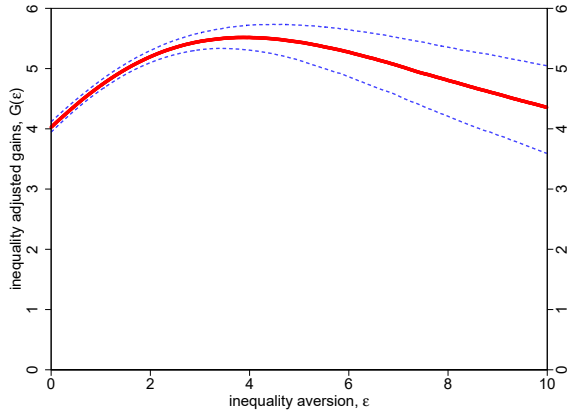
(a) Central African Republic



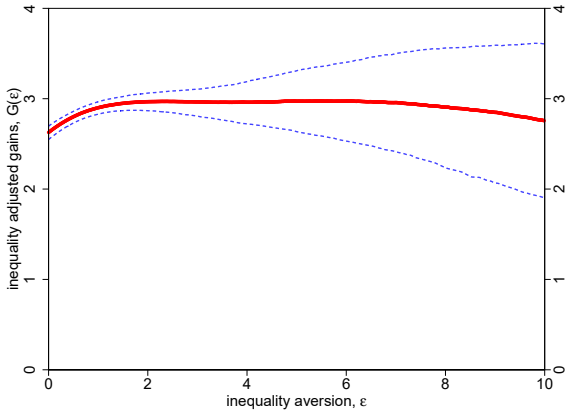
(b) Guinea Bissau



(c) Jordan

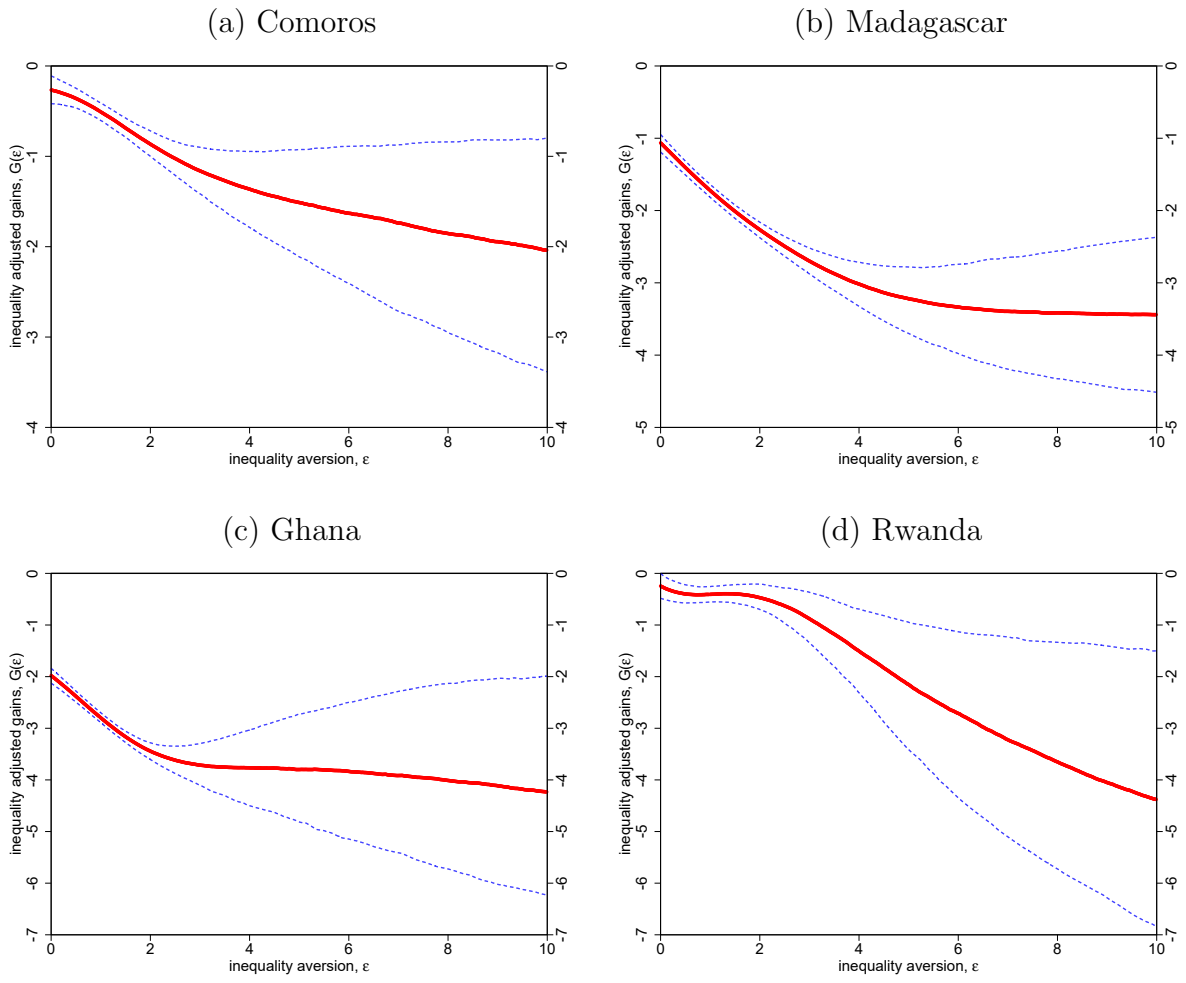


(d) Yemen



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

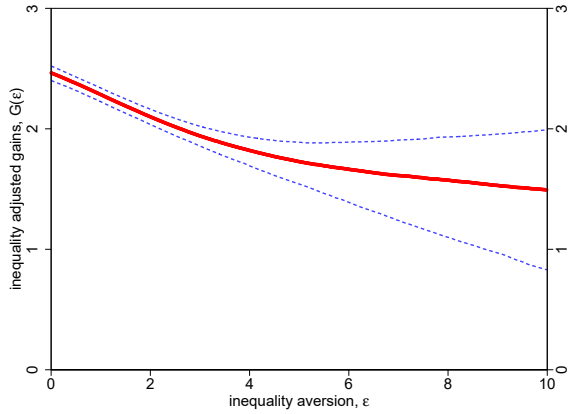
Figure C2
No Trade-off
Income Losses and Inequality Costs
No Trade Policy Preference Ranking Reversals



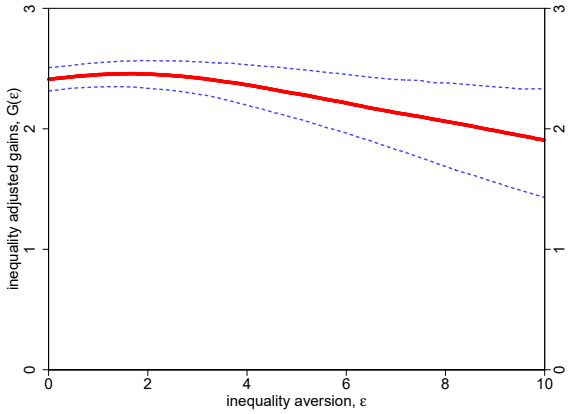
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C3-A
Trade-offs
Income Gains and Inequality Costs
No Trade Policy Preference Ranking Reversals

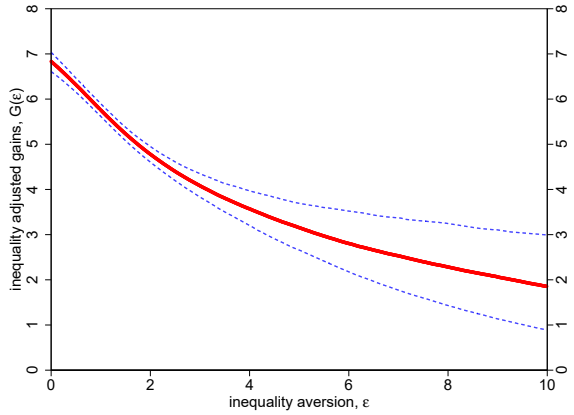
(a) Armenia



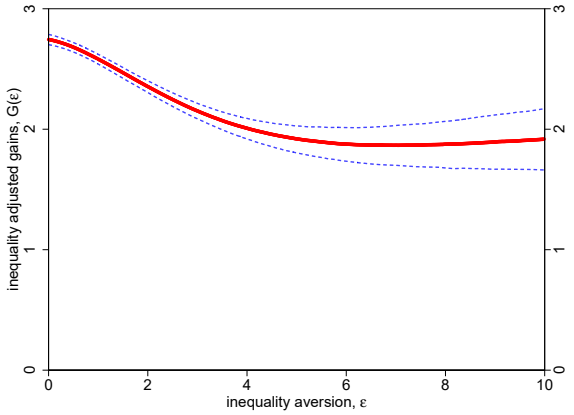
(b) Azerbaijan



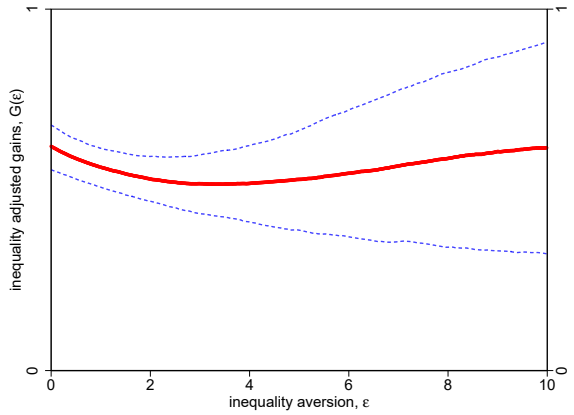
(c) Cameroon



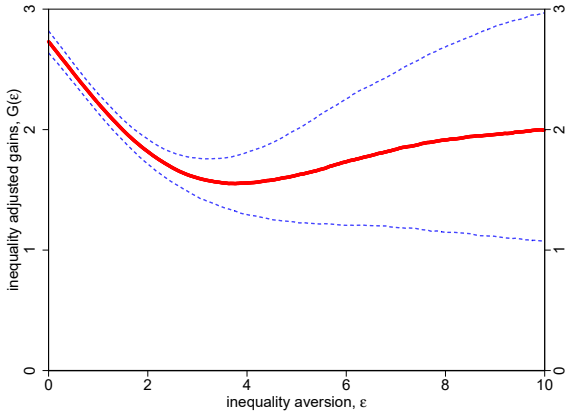
(d) Egypt



(e) Kyrgyz Republic

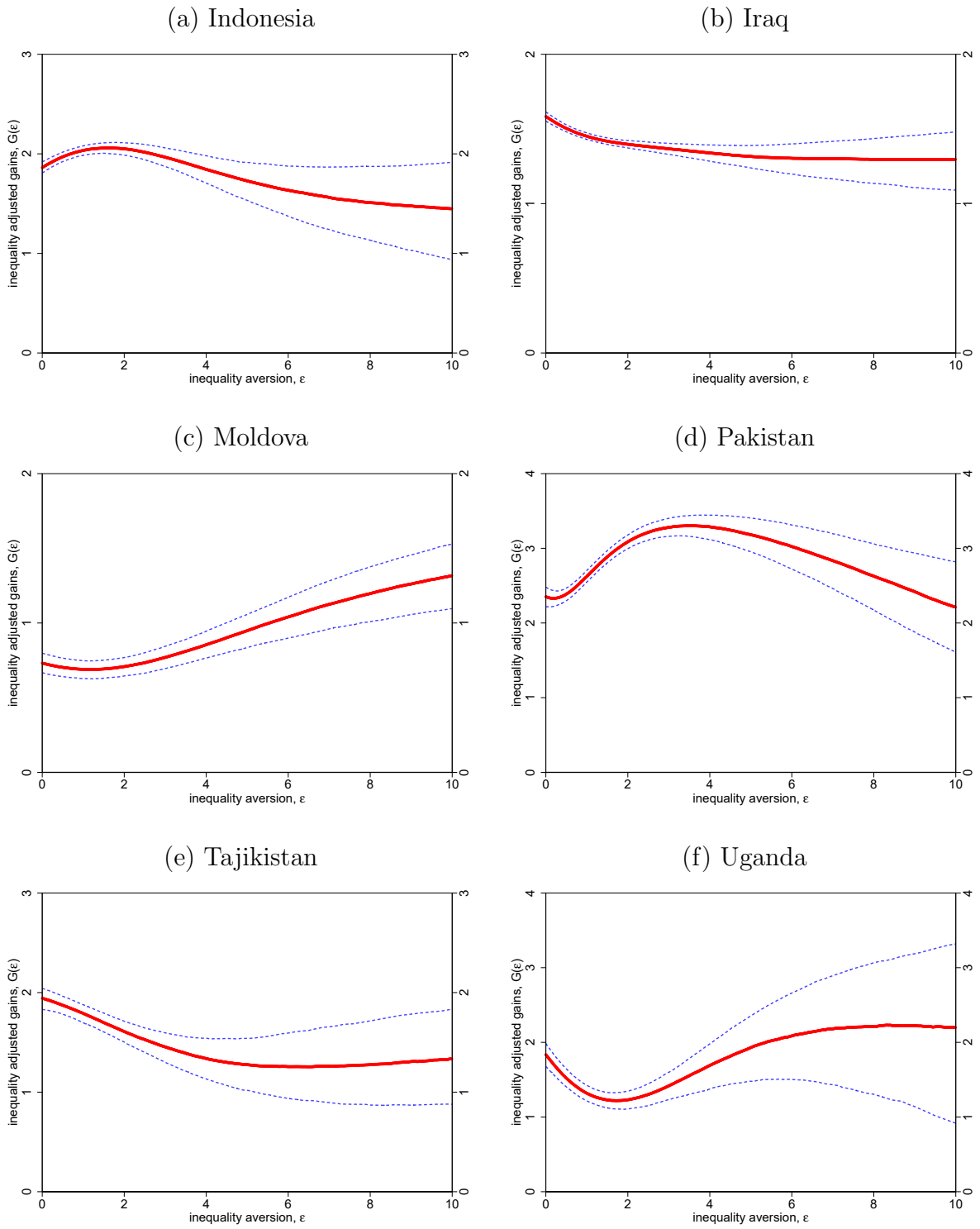


(f) Guinea



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

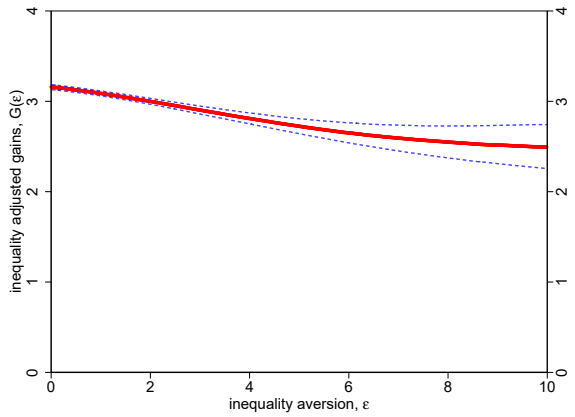
Figure C3-B
Trade-offs
Income Gains and Inequality Costs
No Trade Policy Preference Ranking Reversals



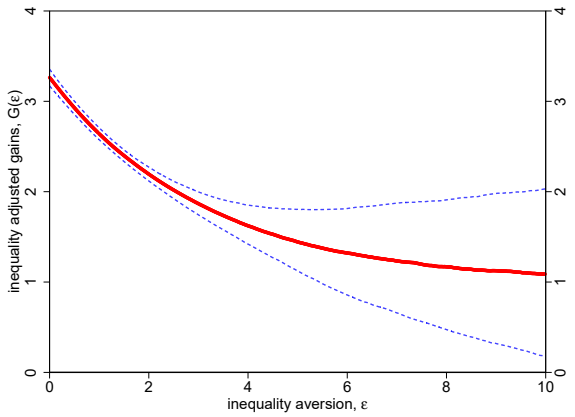
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C3-C
Trade-offs
Income Gains and Inequality Costs
No Trade Policy Preference Ranking Reversals

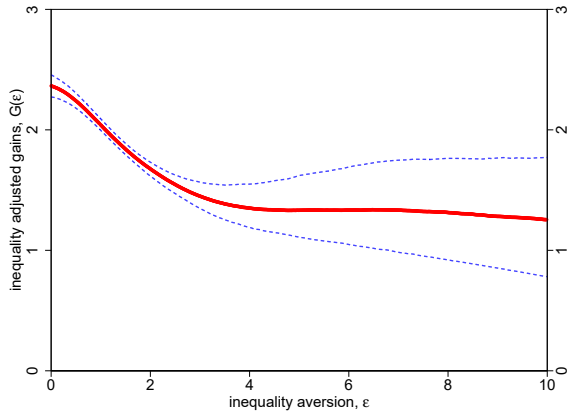
(a) Ukraine



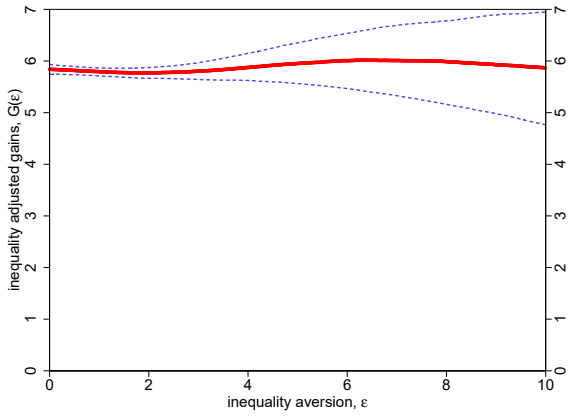
(b) Uzbekistan



(c) South Africa



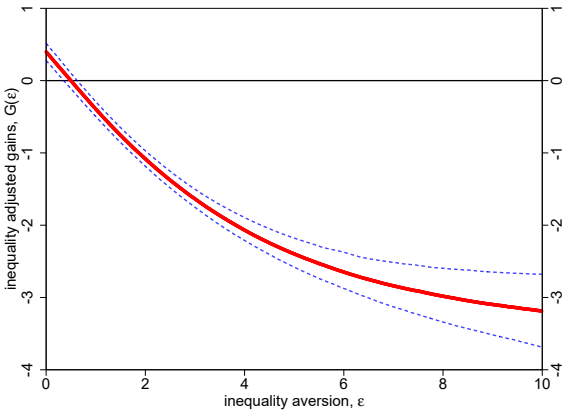
(d) Zambia



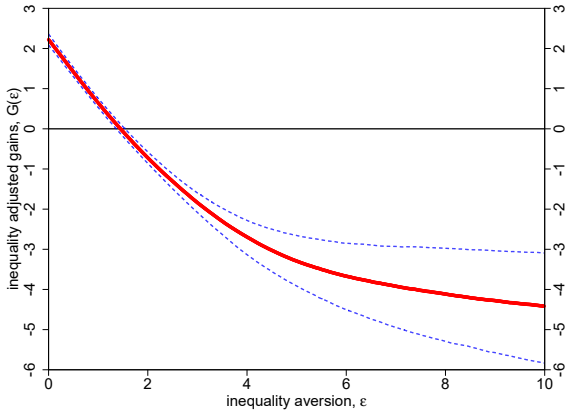
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C4-A
Trade-offs
Income Gains and Inequality Costs
Trade Policy Preference Ranking Reversals

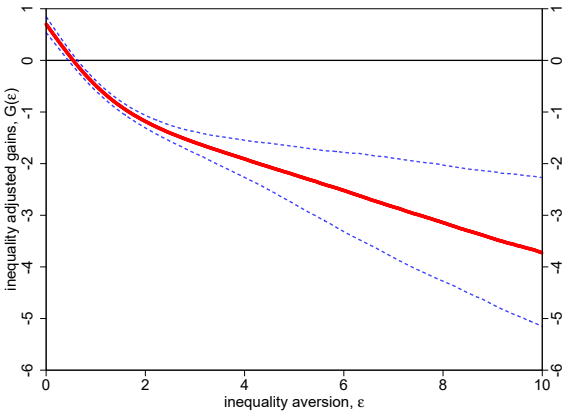
(a) Bangladesh



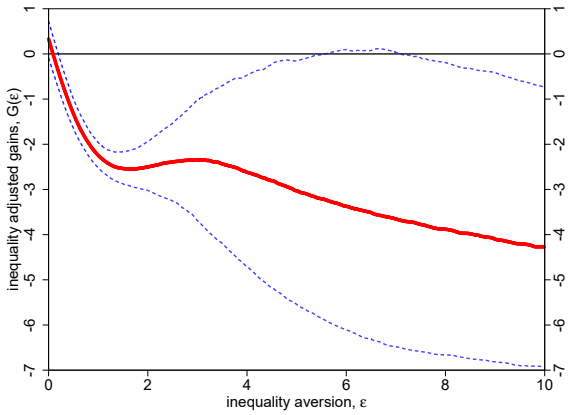
(b) Benin



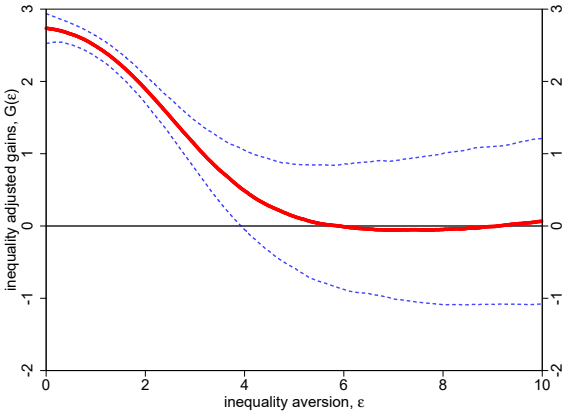
(c) Burkina Faso



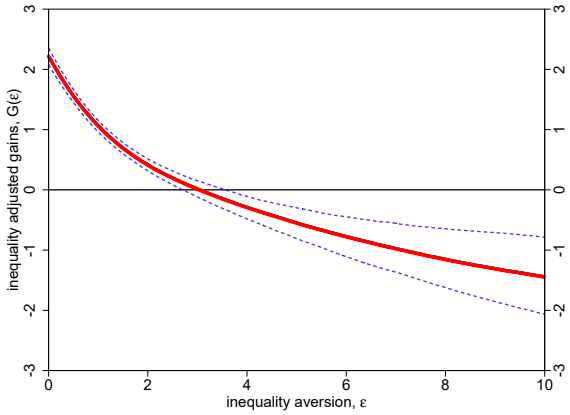
(d) Burundi



(e) Bolivia



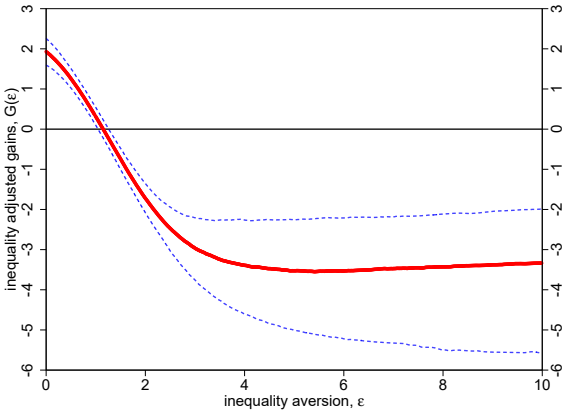
(f) Ethiopia



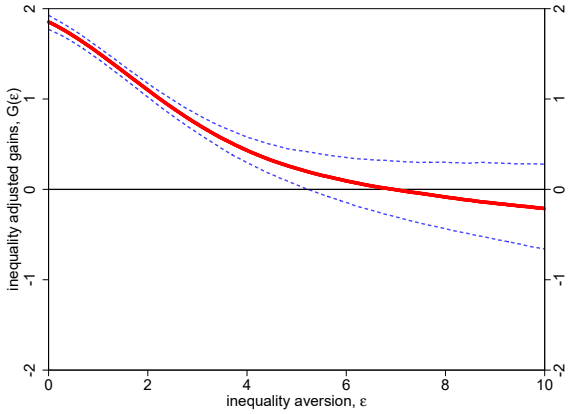
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C4-B
Trade-offs
Income Gains and Inequality Costs
Trade Policy Preference Ranking Reversals

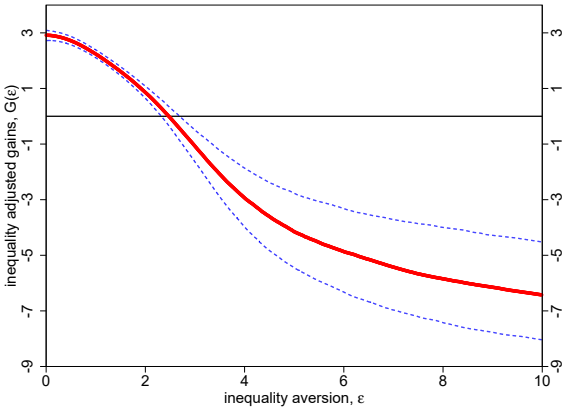
(a) The Gambia



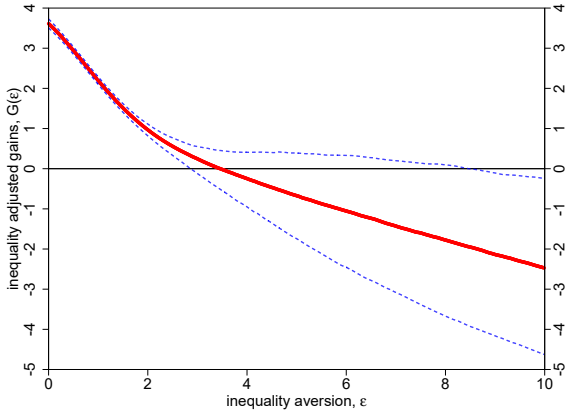
(b) Guatemala



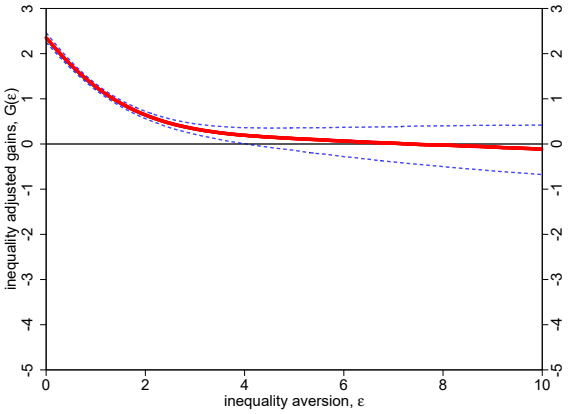
(c) Kenya



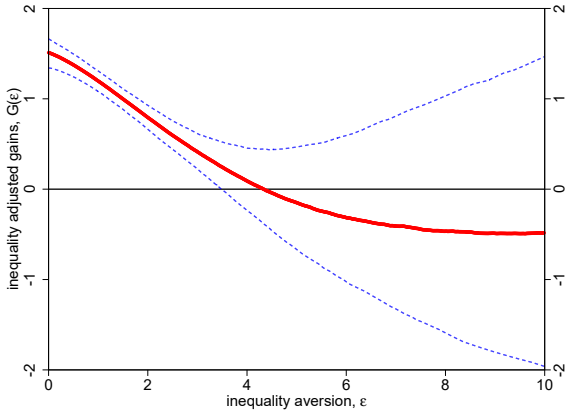
(d) Mozambique



(e) Malawi



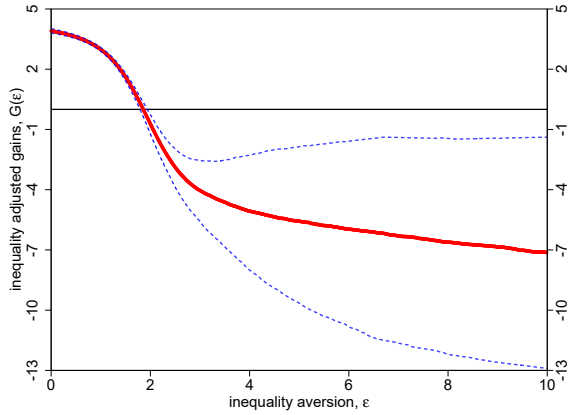
(f) Liberia



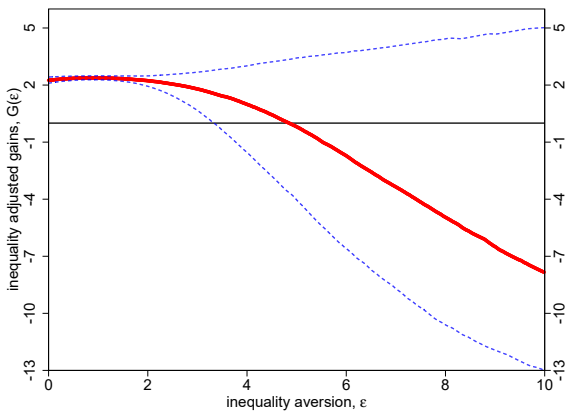
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C4-C
Trade-offs
Income Gains and Inequality Costs
Trade Policy Preference Ranking Reversals

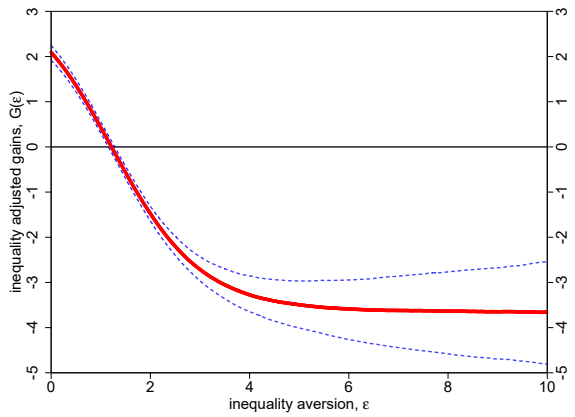
(a) Nigeria



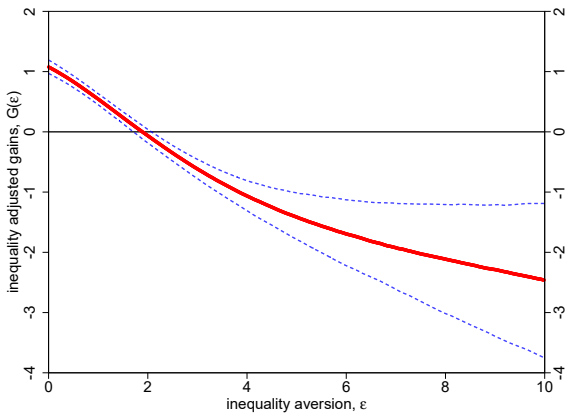
(b) Papua New Guinea



(c) Togo



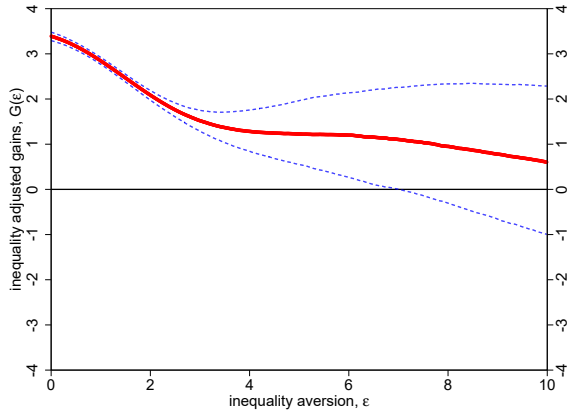
(d) Vietnam



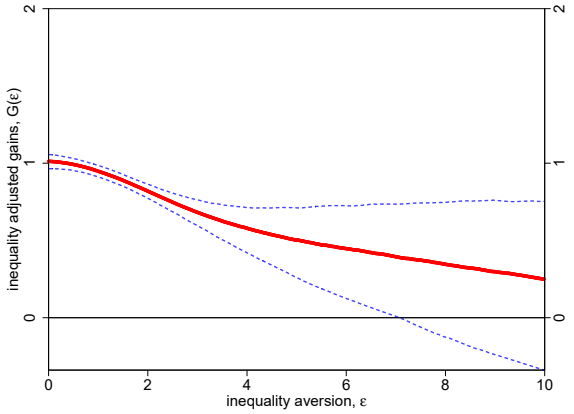
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C5
Trade-offs
Income Gains and Inequality Costs
Potential Trade Policy Preference Ranking Reversals

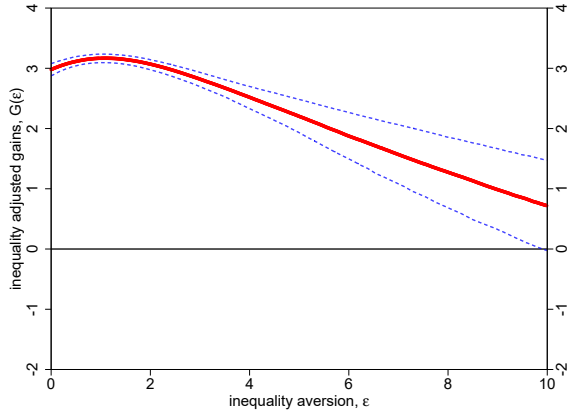
(a) Côte d'Ivoire



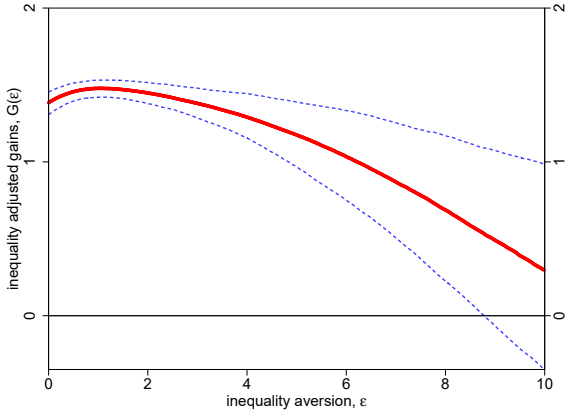
(b) Georgia



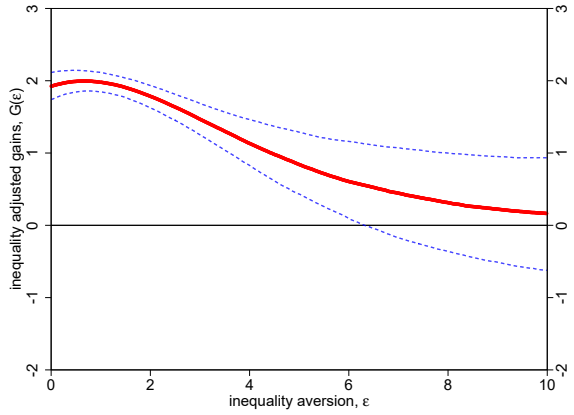
(c) Ecuador



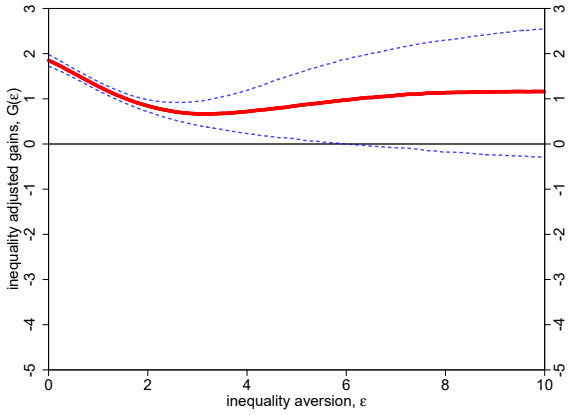
(d) Nepal



(e) Nicaragua



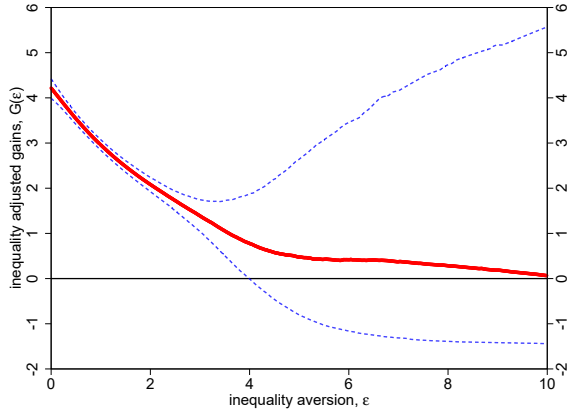
(f) Niger



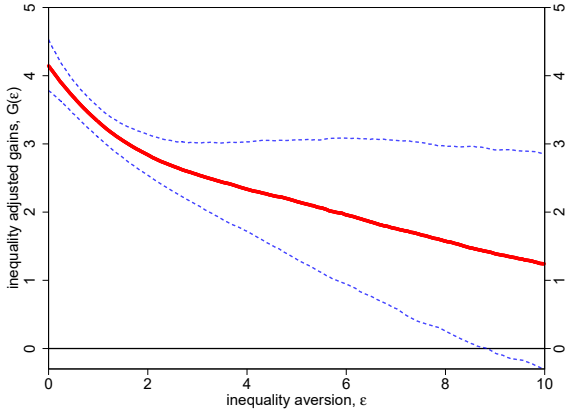
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C5-D
Trade-offs
Income Gains and Inequality Costs
Potential Trade Policy Preference Ranking Reversals

(a) Sierra Leone

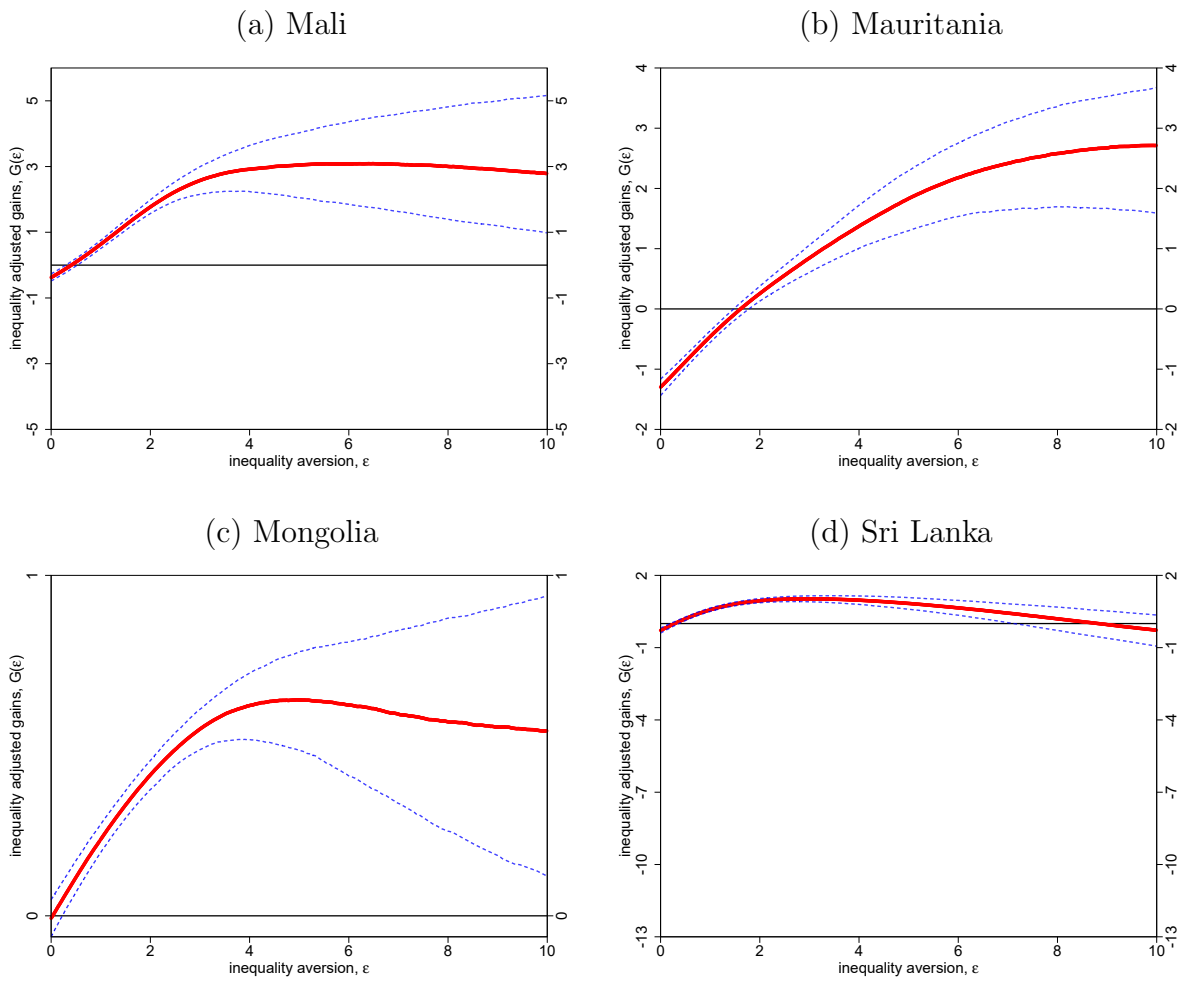


(b) Tanzania



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

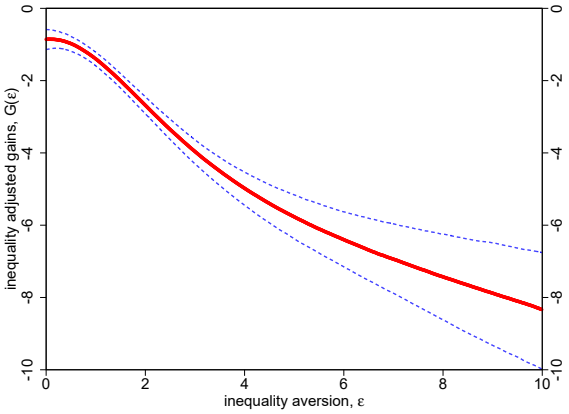
Figure C6
Trade-offs
Income Losses and Equality Gains
Trade Policy Preference Ranking Reversals



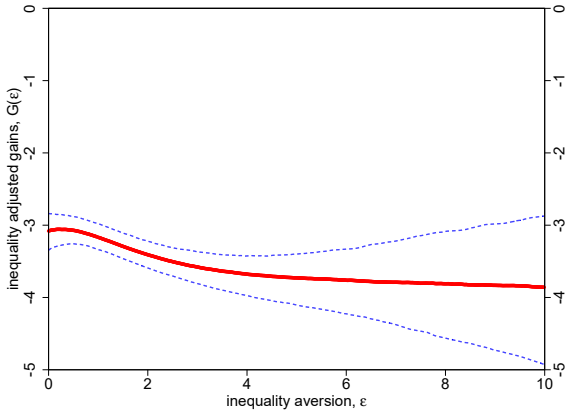
Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Figure C7
Trade-offs
Income Losses and Equality Gains
No Trade Policy Preference Ranking Reversals

(a) Bhutan



(b) Cambodia



Notes: The solid red line depicts how the inequality adjusted welfare gains associated with liberalization $G(\varepsilon)$ vary with inequality aversion ε. The dotted blue lines represent 95% confidence intervals based on 1000 bootstrap replications.

Appendix D: Alternative Model - Allowing for Elastic Labor Supply and Non-Trade Goods Price Responses

To assess the robustness of our results, we relax the fixed factors assumption and re-estimate the gains from trade using an alternative model that allows non-traded sector prices (NT prices) and wages in all sectors to respond endogenously to tariffs changes. This alternative specification closely follows Artuc, Chaudhuri and McLaren (2010) and Artuc, Lederman and Porto (2015), henceforth ALP.[13] This model can be estimated using labor market data, and then it can generate wage price elasticities through simulations. Thus the simulation of this empirical model allows us to improve the calculation of the impact of tariff cuts on household real incomes by including wage and labor income responses as well as non-traded price responses (which in turn affect consumption and household enterprise income effects).

[13]Dix-Carneiro (2014) develops a richer and more flexible model of labor markets with imperfect mobility. This model, however, is very intensive in data requirements and thus is difficult to estimate for all the countries in our sample. See ALP for a thorough discussion.

Before introducing the technical details of the model, a short synopsis of its features will be useful. In this dynamic model, workers can move from one sector to another at a cost that consists of a fixed and a random component. Because of this moving cost, factor price equalization across sectors does not hold and the model can generate wage differentials across sectors (as observed in the data). Workers move between sectors in both directions due to the random component of the moving cost and gross worker flows can be positive even when net worker flows are equal to zero.

Tariff reduction in the protected sectors initially changes the prices and wages in these sectors. Subsequently, the net flow of workers from liberalized sectors to other sectors increase, as workers maximize their expected utility by moving in response to the initial change in the wage distribution. Since the distribution of workers across sectors thereby also changes, the real marginal products of workers adjust, and the equilibrium wages in all sectors respond further to the trade shock. In this setting, the moving cost parameter, which can be estimated using labor market data, is the key parameter. Because the moving cost determines the net flows and the diffusion of trade shocks' from liberalized sectors to the other sectors, it is a crucial determinant of the self and cross price elasticity of wages in subsequent periods.

The ALP model consists of two main theoretical components: (1) Production functions (labor demand and goods supply), and (2) workers' decision (labor supply and goods demand).

Production functions

There are N sectors in the economy, producing homogeneous products in a perfectly competitive environment. Production requires (variable) labor input and a fixed factor such as land. We assume that production functions are simple Cobb-Douglas functions. Calibration of the production functions requires both the total wage bill and average wages for each sector. Since workers receive their marginal product as wages, this simple setup readily generates sector specific labor demand functions. The wage in sector g can be written

as a function of the number of workers, L_t^g and price, p_t^g:

$$(18) \quad w_t^g = p_t^g \frac{\partial Q^g(L_t^g, F^g)}{\partial L_t^g},$$

where F^g is the fixed factor and Q^g is the total real output in sector g adhering to a Cobb-Douglas production technology.

Unlike most of the other trade models, we assume homogeneous products since our model is tailored to low and middle income economies that mainly produce commodities rather than differentiated products, (see ALP section 6 for a detailed discussion). The sectors that we consider are: agriculture; mining; manufacturing; construction; transport, communication, electricity, gas; wholesale and retail trade; finance, insurance, real state; services 1 (education and health related services); services 2 (other services); public administration. We use OECD input-output tables for the calibration when the IO data is available for the country. For others, we use regional averages from the OECD IO tables.

Workers' decisions

Because of computational and data constraints, in what follows we assume that households supply precisely one unit of labor. As a result, the expected wage of a worker is the expected wage of the household, therefore there is no distinction between the household and the worker in this framework. Any given worker is employed in one of the N sectors, she earns wage w_t^g and she consumes a bundle of N goods and services based on her Cobb-Douglas preferences. We assume that workers are risk neutral and have rational expectations.

We begin with the consumption decision. The goods and services demand function is based on a Cobb-Douglas utility, therefore it depends only on the price, p_t^g, income, and the fixed consumption shares. The fixed consumption shares are calibrated for each country separately using the household expenditure and consumption data. The income can be calculated using the wage distribution across sectors, w_t^g, and the number of workers in each sector, L_t^g.

Regarding the labor supply decision, we assume that a worker employed in sector g can

change her sector in every time period after paying a moving cost with fixed and random components. The moving cost can be expressed as $C + \zeta_t^g$ for workers moving to sector g. The fixed component C is common for all workers, while the random component ζ_t^g is specific to workers and drawn from an iid extreme value distribution in every period. In this model, the workers have rational expectations, and decide based on their expected future wages and moving costs. The workers' employment decisions can be separated from their agricultural production and consumption decisions, and can be summarized with the following choice-specific.

The Bellman equation is:

$$(19)\quad U^g(\chi_t, \zeta_t) = w_t^g + \eta^g + \max_{g'} \left\{ \beta E_{t,\zeta} U^{g'}(\chi_{t+1}, \zeta_{t+1}) - \mathbf{1}_{g \neq g'} C - \zeta_t^{g'} \right\},$$

where η^g is the choice specific fixed utility, accounting for non-wage utility such as compensating differentials, β is the inter-temporal discount factor. The choice-specific present discounted utility, $U^g(\chi_t, \zeta_t)$, is a function of the vector of random moving cost shocks, $\zeta_t = [\zeta_t^1, \zeta_t^2, ..., \zeta_t^N]$ and the aggregate state variable χ_t. Note that the aggregate state variable χ_t consists of present and future expected wage information Ew_{t+n}^g as well as present and future expected price information $E_t p_{t+n}^g$ for every $g \in 1, 2, .., N$ and $n \geq 0$. Given the Bellman equation above, the total number of workers in sector g can be written as a function of only χ_t.[14] We assume that workers decide their next sector of employment based on their expectations at the end of the current period.[15] Thus the number of workers, or the labor supply, for the next period can be expressed as:

$$(20)\quad L_{t+1}^g = \mu^g(\chi_t),$$

using the estimate of the fixed moving cost parameter, C, the variance of the random cost, ζ^t, the choice-specific fixed utility parameter, η^g, and the discount factor β. ALP estimate moving costs for 56 countries. If our target countries are in the ALP sample, we work with

[14] Please see ALP for a detailed discussion and a formal derivation of the equations.

[15] The timing assumption is not critical, we simply follow the timing convention of previous research.

the corresponding estimate of labor mobility costs. For those countries that are in our sample but not in theirs, we use regional averages instead. Other parameters are calibrated as in ALP.

Equilibrium

The equilibrium in the goods market determines the prices, p_t^g, for the non-traded sectors. The prices in the traded sectors are given exogenously. Calculation of the goods market equilibrium is relatively straightforward as it only requires setting supply equal to the demand, which are both Cobb-Douglas functions. Therefore only the total income, the distribution of production factors (i.e.labor), and the parameters of the Cobb-Douglas production and utility functions are required to calculate the goods-market equilibrium.

The labor market equilibrium can be characterized with the state variable χ_t where the labor allocations implied by the workers optimization problem in (19) and (20), i.e. labor supply, are equal to the labor allocations implied by the labor demand equations, (18), for the given χ_t.

6.1 Calibration at the steady state

We assume that there are no aggregate shocks apart from the trade shocks in the economy, i.e. $\chi_{t+1} = \chi_t$. We take the labor allocations, L_t^g, and wages, w_t^g, from the data, and impose them for future wages and labor allocations, i.e. set $L_{t+1}^g = L_t^g$, and $w_{t+1}^g = w_t^g$. We normalize prices to be equal to unity before the trade shock. Thus, it is possible to construct the state variable χ_t with the available wage data and normalization of prices for the steady state before the unanticipated trade shock. We take the Cobb-Douglas production function parameters from IO tables and Cobb-Douglas expenditure share parameters from the household data. We calibrate the remaining technology and utility function parameters such that equations (18) and (20) are satisfied for the steady state χ_t implied by the data.

Trade shock simulations

In this set up, we simulate a full unanticipated trade liberalization shock (i.e., full elimination of tariffs on agricultural goods and manufactures), consistent with the tariff cuts utilized to measure the price changes for all terms in the first order approximation formula:

$$(21)\quad \frac{dV_i^h}{e^h} = -\left(-s_i^h - \sum_{k\in NT} s_k^h \frac{\partial p_k}{\partial p_i}\frac{p_i}{p_k} + \phi_w^h \frac{\partial l^h}{\partial p_i}\frac{p_i}{l^h} + \phi_i^h + \sum_{k\in NT} \phi_k^h \frac{\partial p_k}{\partial p_i}\frac{p_i}{p_k}\right)\frac{\tau_i}{1+\tau_i} + \Psi_i^h.$$

Note that this formula is similar to equation (6) but now also accounts for non-traded goods price responses.

The trade shock is characterized by an unexpected price change in the traded-goods sectors at time t after the reduction of tariffs, implied by equation (5). With this price change, wages in the traded-goods sectors decrease instantaneously since the wage in given sector is equal to the price times the marginal product of labor. Consequently, workers respond to the decrease in traded-goods sector wages, and the labor allocation changes, which in turn changes wages further as the marginal product of labor changes. Meanwhile, the demand for goods change as income changes. The supply of goods changes simultaneously as the semi-flexible production factor, labor, reallocates.

In order to solve this model, we need to solve the current and future wages and prices simultaneously since decisions today depend on the expected wages and prices in the future. This procedure is equivalent to finding a fixed point for χ_t using equations (18) and (20). The details of the simulation algorithm are described in ALP.[16]

Once we obtain the new fixed point for the state variable χ_t through the simulations, we uncover the wage responses $\partial w_t^g/\partial p^i$ as well as of the non-traded price responses $\partial p_t^k/\partial p^i$ for all sectors and future time periods, as elements of the state variable χ_t. Note that there is no aggregate uncertainty after the trade shock, i.e. $E_t w_{t+n}^g = w_{t+n}^g$. We can therefore safely ignore the expectation operator for the aggregate variables in the simulations.

[16] In short, we impose the non-traded goods prices into χ_t and solve for the remaining equilibrium wages, w_{t+n}^g and prices, p_{t+n}^g for every $n \geq 0$.

Response of wages after the trade shock

Given these simulation results, we can summarize the wage responses. In what follows, we work with present discounted total wage income responses that take into account the entire expected evolution of wages. For a worker who is initially in sector g, we calculate:

$$(22) \quad \widehat{\frac{\partial w^g}{\partial p^i}} = \sum_t \beta^t \frac{\partial w_t^g}{\partial p^i},$$

where β is the discount factor.

The intertemporal nature of equation (22) is a consequence of the dynamic set up of Artuc, Chaudhuri and McLaren (2010) that we use to estimate these effects. Because our household welfare metric (equation (1)) is static, three important clarifications must be made. First of all, to derive the welfare effects (21), we compute the first order effects of a price change. In this approximation, household adjustments (such as consumption or production responses) are second order effects, but the responses of wages and non-traded prices are first order effects.[17] Second, equation (22) is actually a first order approximation to the change in the lifetime welfare of a worker that stays in sector g so that this approximation is in fact consistent with our focus on first order effects.[18] Finally, to fit this lifetime change into our framework, we need to calculate $\partial l^h/\partial p_i$ (in (6)) such that its present discounted value is (22). Thus, our estimates of the labor income effect are

$$(23) \quad \widehat{\frac{\partial l^h}{\partial p^i}} = (1-\beta) \sum_t \beta^t \widehat{\frac{\partial w_t^g}{\partial p^i}},$$

where $\widehat{\frac{\partial w_t^g}{\partial p^i}}$ are imputed using the simulated wage responses.

[17] To elaborate on this point, the argument is the following. To first order, the dynamic adjustment of the household, in terms of consumption and production decisions, can be ignored. As a result, this first order approximation does have an error, but this error (which includes dynamic adjustments) is small (under the standard assumption that households are optimizing consumption and production decisions). The adjustment of wages is instead a first order effect and, consequently, not including it leads to first order errors. See Porto (2006).

[18] For a formal derivation and discussion of this result, see Artuc, Chaudhuri and McLaren (2010) and ALP.

We follow a similar approach to estimate the responses of the prices of non-traded goods:

$$(24) \quad \widehat{\frac{\partial p_k}{\partial p^i}} = (1-\beta)\sum_t \beta^t \widehat{\frac{\partial p_t^k}{\partial p^i}}.$$

6.2 Results

The estimates, reported in Table D1, show that when trade is liberalized, agricultural wages drop most precipitously, by 7.3 percent on average across countries, reflecting the comparatively high tariffs on agriculture in the status quo and the fact that the tariff shock directly impacts the price of agricultural goods. Unlike our main model, wages in other sectors also decrease, as we are now allowing for general equilibrium effects in (21). Wage decreases tend to be larger in countries in which tariffs were higher to begin with such as Bhutan and the Central African Republic, and smaller in countries in which tariffs were relatively low, such as Georgia and the Ukraine. The heterogeneity in initial tariffs, in conjunction with differences in labor allocation and moving costs, explains why wage responses are heterogeneous across both countries and sectors.

The most salient feature of these results, reported in Table D2, is that price responses of the non-traded goods are negative for all goods in all countries. This result is to be expected because the reduction in tariffs reduces nominal income losses, which reduces the demand for non-traded goods and consequently puts downward pressure on prices. Overall, the magnitude of the price change is lower for non-traded goods than for traded goods, mostly because the former are driven by endogenous responses of the economy in general equilibrium. However, the estimated price changes of both traded and non-traded goods can be sizeable, as they are in Bhutan and the Central African Republic, where prices decline by more than 10 across sectors. Other countries with substantial price declines across sectors are Burkina Faso, Rwanda and Togo. These results depend not only on the size of the initial tariff cut but also on the relative importance of the tradable sectors in the economy.

The response of non-tradeables prices also results in reduced revenue for households running non-farm enterprises producing such non-tradeables, yet is a boon for consumers. As a result of these effects and the different wage responses, estimated gains from trade also

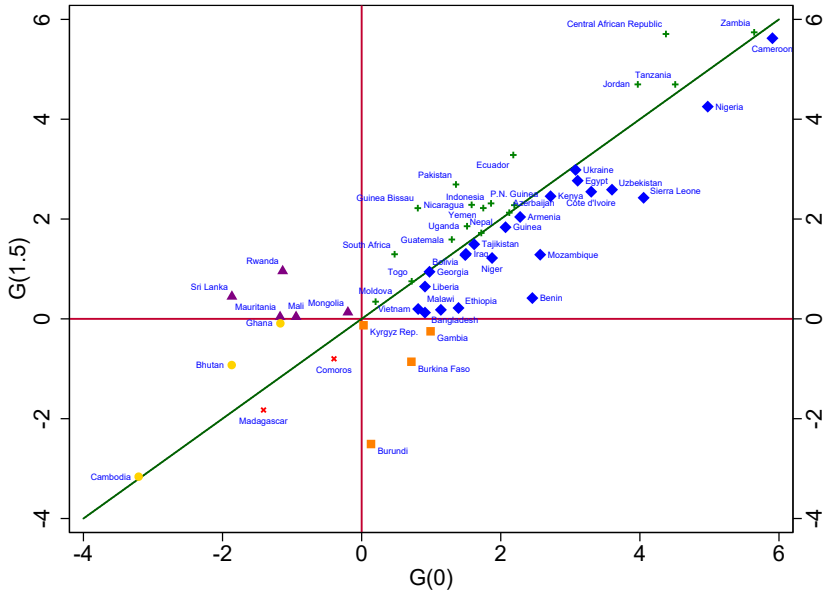
change relative to the baseline model presented in the main text. Tables D3 and D4 present estimates of the gains from trade, and how they arise, for winners and losers respectively. We continue to find gains in 44 countries and losses in 10 countries. Non-traded good prices responses yield consumption gains that are on average 0.7 percent across countries. However, they also result in sharper reductions in wages and enterprise income. On average, estimated aggregate gains from trade are 0.3 percent lower across countries then in our baseline model.

The pattern of inequality adjusted gains from trade, presented in Table D5, remains very similar to our baseline model. There is marked heterogeneity across countries, yet gains from trade are positive on average, and tend to fall as inequality aversion rises. Again, average income gains are inversely correlated with equality gains.

For purposes of comparison, Figure D1 demonstrates how the resulting trade-offs are resolved using this alternative model using $\varepsilon = 1.5$. As in our main model, these trade-offs are typically resolved in favor of liberalization. Overall, the patterns of results and conclusions presented in the main text are qualitatively robust to using this alternative model.

Figure D1
Trade-Off Resolution
Alternative Model

(a) $\varepsilon = 1.5$



Notes: scatter plot of the inequality-adjusted gains from trade $G(\varepsilon)$ against the gains from trade $G(0)$, for $\varepsilon = 1$ (panel a) and $\varepsilon = 2$ (panel b). The symbols represent the trade-off resolution: ✚: no trade-off, liberalize; ◆: soft trade-off, liberalize; ■: policy reversal, liberalize; ✖: no trade-off, protect; ▲: policy reversal, protect; ●: soft trade-off, protect. The gains from trade are calculated using a model that allows for labor market frictions and non-traded goods price responses, discussed in detail in Appendix D.

Table D1
Alternative Model
Wage Responses

	Ag	Mining	Manuf	Constr	Tansp	Retail	Banks	Serv 1	Serv 2	Adm
Benin	-7.6	-4.6	-6.5	-5.1	-4.9	-5.6	0.0	-4.1	-5.6	-6.0
Burkina Faso	-12.0	-9.1	-9.6	-10.1	-10.2	-9.1	-9.2	-8.6	-9.8	0.0
Burundi	-12.4	0.0	-6.5	-4.3	-5.3	-6.7	-1.2	-6.4	0.0	-7.0
Cameroon	-11.1	-8.4	-12.4	-8.8	-9.3	-7.6	-10.3	-6.1	0.0	0.0
Central African Rep.	-13.8	0.0	-14.6	-13.4	-13.2	-13.0	0.0	-11.7	-13.2	-13.4
Comoros	-3.0	-2.4	-5.0	-3.1	-3.4	-3.6	-2.5	-2.4	-3.5	0.0
Côte d'Ivoire	-6.1	-4.0	-5.7	0.0	-3.7	-4.6	-3.2	-3.1	0.0	-4.1
Egypt	-2.8	-2.1	-6.2	-2.3	-3.3	-2.5	-3.8	-2.4	-2.7	-3.1
Ethiopia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
The Gambia	-6.3	-3.5	-7.4	-4.9	-5.2	-5.2	-5.2	-4.2	-5.6	-5.7
Ghana	-11.6	-7.9	-10.5	-9.0	-8.9	-8.8	-8.1	-7.3	-8.8	-8.8
Guinea	-11.1	-6.8	-8.5	-7.8	-7.8	-7.6	0.0	-6.2	-7.7	-7.7
Guinea Bissau	-11.7	-8.3	-9.7	-9.1	-9.2	-9.1	0.0	-7.8	-9.2	-9.2
Kenya	-13.2	-6.9	-8.9	-8.6	-8.6	-8.6	-7.7	-5.6	-8.6	-8.6
Liberia	-3.7	-3.0	-6.5	-4.5	-3.1	-2.1	-5.3	-2.0	-2.2	-4.6
Madagascar	-6.1	-4.1	-7.9	-5.4	-5.8	-5.5	-5.9	-3.0	-5.4	-6.0
Malawi	-11.0	0.0	-8.5	-8.6	-7.8	-8.4	-7.1	-6.2	-7.9	-7.7
Mali	-10.7	-7.3	-9.3	-9.6	-9.3	-9.7	0.0	-7.1	-9.3	-9.3
Mauritania	-7.7	-4.0	-8.1	-3.9	-5.3	-4.0	0.0	-1.5	0.0	-5.5
Mozambique	-6.0	-4.0	-5.2	-4.3	-4.4	-4.2	-4.1	-2.0	-4.3	-4.4
Niger	-8.3	-5.9	-6.8	-6.3	-5.8	-6.3	0.0	-4.3	-6.6	-6.8
Nigeria	-10.9	-6.9	-9.4	-9.1	-9.7	-9.3	-7.6	-8.2	0.0	0.0
Rwanda	-15.1	-7.2	-9.7	-9.9	-9.9	-9.9	-8.3	-5.5	0.0	-10.0
Sierra Leone	-4.2	-2.6	-3.7	-2.1	-1.8	-1.2	-3.6	-1.6	-2.0	-1.8
South Africa	-5.3	-5.1	-8.1	-5.1	-5.7	-5.2	-6.0	-4.7	-6.0	-6.0
Tanzania	-11.4	-6.7	-9.0	0.0	-7.6	-8.1	-6.9	-6.1	0.0	-7.7
Togo	-10.6	-8.1	-10.3	-10.0	-9.7	-9.5	-8.1	-7.0	-10.2	-8.9
Uganda	-12.9	-7.1	-8.7	-8.2	-8.1	-8.2	-7.2	-5.8	-7.9	-8.0
Zambia	-8.0	-3.0	-4.0	0.0	-2.4	-1.8	-3.7	-2.0	0.0	-2.9

Notes: Authors' calculations. The numbers in the table are the proportional average wage responses expressed in percentage points to a full tariff elimination shock (in agriculture and manufacturing). The wage responses are estimated with simulation methods using the model and data from Artuc, Lederman, and Porto (2015).

Table D1
Alternative Model
Wage Responses (Continued)

	Ag	Mining	Manuf	Constr	Tansp	Retail	Banks	Serv 1	Serv 2	Adm
Armenia	-2.6	-1.0	-3.4	-1.7	-1.7	-1.6	-1.2	-1.2	-1.4	-1.7
Bangladesh	-6.5	-3.8	-11.8	-5.3	-4.8	-5.2	-4.6	-2.6	-5.8	0.0
Bhutan	-23.9	-12.5	-16.1	-15.0	-15.0	-15.0	-13.2	-12.4	-14.9	-15.0
Cambodia	-3.8	-3.5	-5.4	-3.8	-3.8	-3.8	-3.9	-3.4	-3.8	-3.8
Indonesia	-1.8	-2.2	-3.2	-2.1	-2.4	-2.1	-2.8	-2.0	0.0	0.0
Iraq	-1.8	-1.6	-2.3	0.4	-1.2	-0.4	-1.3	-0.5	-1.5	-1.7
Jordan	-5.6	-2.7	-6.1	-3.1	-3.1	-2.9	-2.3	-1.3	-3.1	-2.9
Kyrgyz Republic	-3.1	-2.0	-3.0	-2.6	-2.6	-2.6	-2.1	-1.7	-2.6	-2.6
Mongolia	-1.8	-1.4	-1.7	-1.1	-1.2	-1.0	-1.0	-0.8	-1.0	-1.0
Nepal	-8.0	-5.3	-8.4	-6.3	-6.4	-6.4	-5.8	-5.2	-6.4	-6.5
Pakistan	-5.4	-4.1	-8.1	-5.4	-5.0	-4.5	-5.3	-3.2	-5.4	0.0
Papua New Guinea	-3.0	-1.2	-1.2	-1.2	-1.2	-1.2	-1.0	-0.8	-1.2	-1.3
Sri Lanka	-8.0	-5.3	-9.6	-7.2	-7.2	-7.3	-5.8	-5.4	-7.2	-7.1
Tajikistan	-5.3	-3.6	-5.1	-4.4	-4.4	-4.4	-3.8	-2.9	-4.3	-4.4
Uzbekistan	-6.0	-4.2	-6.6	-4.9	-4.7	-5.0	-4.5	-4.0	-4.5	-4.8
Vietnam	-6.0	-4.5	-6.1	-4.4	-4.8	-4.6	-4.7	-3.5	-4.7	-4.6
Yemen	-3.8	-3.2	-4.6	-3.6	-3.6	-3.8	-3.4	-2.9	-3.6	-3.6
Azerbaijan	-4.4	0.0	-6.8	-4.7	0.0	-3.6	0.0	-2.1	-3.5	-3.8
Georgia	-2.1	-0.5	-0.7	-0.8	-0.8	-0.8	-0.6	-0.5	-0.8	-0.8
Moldova	-4.5	-1.8	-3.0	-2.8	-2.8	-2.8	-2.3	-2.1	-2.8	-2.8
Ukraine	-2.2	-0.2	-2.2	-0.8	-0.7	-0.6	-0.7	-0.3	-0.6	-0.9
Bolivia	-6.8	-5.6	-7.6	-6.1	-6.2	-6.3	-6.2	-5.1	-6.3	-6.3
Ecuador	-6.5	-4.5	-5.6	-5.1	-5.1	-5.1	-4.6	-4.1	-5.0	-5.1
Guatemala	-8.0	-6.4	-7.9	-5.6	-6.2	-5.8	-6.5	-4.5	-6.2	-6.8
Nicaragua	-6.9	-4.9	-6.2	-5.5	-5.4	-5.5	-5.0	-4.5	-5.4	-5.4
Average	-7.3	-4.2	-6.8	-5.1	-5.4	-5.3	-4.0	-4.1	-4.4	-4.7

Notes: Authors' calculations. The numbers in the table are the proportional average wage responses to a full tariff elimination shock (in agriculture and manufacturing). The wage responses are estimated with simulation methods using the model and data from Artuc, Lederman, and Porto (2015).

Table D2
Alternative Model
Non-Traded Goods Price Responses

	Const.	Transp.	Retail	Other Services	Adm
Benin	-4.5	-4.2	-4.6	-4.9	-5.7
Burkina Faso	-10.3	-10.3	-9.9	-10.1	0.0
Burundi	-7.0	-8.0	-8.4	0.0	-7.5
Cameroon	-7.1	-6.8	-6.3	0.0	0.0
Central African Republic	-12.8	-12.5	-12.5	-12.9	-13.4
Comoros	-2.9	-2.9	-3.1	-3.2	0.0
Côte d'Ivoire	0.0	-3.6	-4.0	0.0	-4.1
Egypt	-2.4	-2.7	-2.4	-2.7	-3.0
Ethiopia	-6.8	-6.8	-6.7	-6.8	-6.4
The Gambia	-3.9	-3.7	-3.8	-4.5	-5.3
Ghana	-7.9	-7.6	-7.7	-8.1	-8.6
Guinea	-6.5	-6.1	-6.2	-6.8	-7.4
Guinea Bissau	-8.2	-8.0	-8.1	-8.5	-9.0
Kenya	-8.7	-8.7	-8.7	-8.7	-8.7
Liberia	-3.3	-2.4	-2.1	-2.2	-4.3
Madagascar	-5.0	-5.0	-5.0	-5.1	-5.9
Malawi	-8.4	-8.0	-8.2	-8.0	-7.9
Mali	-9.5	-9.2	-9.4	-9.3	-9.4
Mauritania	-4.1	-4.6	-4.2	0.0	-5.4
Mozambique	-4.2	-4.1	-4.1	-4.2	-4.4
Niger	-6.7	-6.6	-6.7	-6.8	-7.0
Nigeria	-8.9	-9.0	-8.9	0.0	0.0
Rwanda	-10.8	-11.0	-10.9	0.0	-10.4
Sierra Leone	-2.1	-2.0	-1.7	-2.0	-1.9
South Africa	-4.1	-4.0	-4.1	-4.8	-5.8
Tanzania	0.0	-6.0	-6.4	0.0	-7.4
Togo	-10.3	-10.3	-10.2	-10.4	-9.3
Uganda	-7.7	-7.5	-7.6	-7.7	-8.0
Zambia	0.0	-1.0	-0.9	0.0	-2.6

	Const.	Transp.	Retail	Other Services	Adm
Armenia	-1.3	-1.4	-1.4	-1.3	-1.7
Bangladesh	-4.7	-3.6	-4.2	-4.4	0.0
Bhutan	-14.2	-13.9	-14.1	-14.4	-14.9
Cambodia	-3.2	-2.6	-2.8	-3.1	-3.7
Indonesia	-2.0	-2.0	-2.0	0.0	0.0
Iraq	-0.2	-0.7	-0.5	-1.2	-1.4
Jordan	-2.9	-2.9	-2.8	-3.0	-2.9
Kyrgyz Republic	-2.7	-2.7	-2.7	-2.7	-2.7
Mongolia	-0.8	-0.8	-0.8	-0.8	-1.0
Nepal	-6.1	-5.8	-6.0	-5.9	-6.4
Pakistan	-5.1	-4.5	-4.3	-4.8	0.0
Papua New Guinea	-1.1	-1.0	-1.0	-1.1	-1.2
Sri Lanka	-7.0	-6.7	-6.9	-6.8	-7.0
Tajikistan	-4.3	-4.3	-4.3	-4.3	-4.4
Uzbekistan	-3.4	-2.9	-3.2	-3.4	-4.4
Vietnam	-3.9	-3.8	-3.8	-4.2	-4.3
Yemen	-3.5	-3.5	-3.5	-3.6	-3.6
Azerbaijan	-4.0	0.0	-3.4	-3.4	-3.7
Georgia	-0.8	-0.8	-0.8	-0.8	-0.8
Moldova	-2.7	-2.7	-2.8	-2.8	-2.8
Ukraine	-0.7	-0.6	-0.6	-0.6	-0.9
Bolivia	-5.4	-5.2	-5.1	-5.8	-6.4
Ecuador	-4.7	-4.6	-4.6	-4.8	-5.0
Guatemala	-4.8	-4.7	-4.7	-5.4	-6.4
Nicaragua	-5.1	-5.0	-5.0	-5.3	-5.5
Average	-5.0	-5.0	-5.1	-4.3	-4.8

Notes: Authors' calculations. The numbers in the table are the proportional average non-traded price responses to a full tariff elimination shock (in agriculture and manufacturing). The non-traded price responses are estimated with simulation methods using the model and data from Artuc, Lederman, and Porto (2015).

Table D3
Alternative Model
Gains from Trade - Winners

	Gains	Expenditure			Income				
		traded	non-traded	total	agric.	wage	enter.	rev.	total
Cameroon	5.9	12.5	0.5	13.0	-1.7	-1.8	-1.7	-1.9	-7.1
Zambia	5.6	9.0	0.0	9.0	-1.1	-0.7	-0.8	-0.8	-3.3
Tanzania	4.5	8.8	0.5	9.3	-1.7	-1.1	-0.3	-1.7	-4.8
Nigeria	4.4	8.3	0.6	8.9	-1.0	-1.6	-0.6	-1.3	-4.5
Central African Republic	4.4	10.8	1.2	12.0	-4.5	-0.4	-0.6	-2.1	-7.6
Sierra Leone	4.1	7.4	0.2	7.7	-1.6	-0.3	-0.2	-1.5	-3.6
Jordan	4.0	8.3	0.9	9.2	-0.4	-1.1	-0.3	-3.4	-5.2
Uzbekistan	3.6	7.0	0.3	7.3	-0.9	-1.0	-0.6	-1.2	-3.7
Côte d'Ivoire	3.3	7.2	0.7	7.9	-1.7	-0.5	-1.3	-1.1	-4.6
Ethiopia	3.1	6.6	0.7	7.2	-1.4	-1.1	-0.6	-1.0	-4.1
Ukraine	3.1	4.6	0.1	4.7	-0.2	-0.4	-0.0	-0.9	-1.6
Kenya	2.7	8.6	1.9	10.5	-2.8	-3.0	-0.4	-1.6	-7.8
Mozambique	2.6	7.2	0.4	7.6	-1.1	-1.2	-0.8	-2.0	-5.0
Benin	2.4	7.7	0.5	8.2	-2.0	-0.5	-0.0	-3.2	-5.8
Armenia	2.3	4.1	0.2	4.4	-0.5	-0.6	-0.1	-0.9	-2.1
Papua New Guinea	2.2	4.7	0.1	4.8	-2.3	-0.2	-0.1	0.0	-2.6
Guatemala	2.2	7.3	1.1	8.4	-1.6	-2.7	-0.9	-1.0	-6.2
Azerbaijan	2.1	6.2	0.2	6.4	-2.4	-0.6	0.0	-1.3	-4.3
Guinea	2.1	7.8	1.0	8.8	-2.0	-0.7	-1.2	-2.9	-6.8
Niger	1.9	6.3	0.5	6.8	-2.5	-0.4	-0.1	-1.9	-4.9
Indonesia	1.9	3.2	0.2	3.4	-0.2	-0.8	-0.0	-0.6	-1.5
Yemen	1.7	5.4	0.6	6.1	-0.8	-1.4	-0.6	-1.5	-4.3
Nepal	1.7	4.4	1.9	6.3	-0.5	-1.3	-0.7	-2.0	-4.6
Tajikistan	1.6	4.7	0.7	5.4	-0.2	-1.3	-0.4	-2.0	-3.8
Nicaragua	1.6	6.1	1.2	7.2	-1.7	-1.7	-0.9	-1.3	-5.7
Uganda	1.5	6.6	1.6	8.2	-2.2	-1.5	-1.6	-1.4	-6.7
Iraq	1.5	3.5	0.1	3.6	-0.4	-0.4	-0.1	-1.2	-2.1
Bolivia	1.5	6.5	1.3	7.9	-1.2	-2.1	-1.7	-1.3	-6.4
Egypt	1.4	7.3	0.3	7.6	-2.9	-0.0	-1.9	-1.4	-6.2
Pakistan	1.4	5.7	0.4	6.1	-1.4	-1.0	-1.5	-0.8	-4.7
Ecuador	1.3	4.8	1.0	5.8	-0.8	-1.8	-0.9	-0.9	-4.5
Malawi	1.1	6.9	0.7	7.6	-2.4	-1.5	-1.3	-1.2	-6.4
The Gambia	1.0	8.0	0.5	8.5	-0.7	-2.1	-1.1	-3.7	-7.5
Georgia	1.0	2.2	0.2	2.5	-0.6	-0.2	-0.1	-0.6	-1.5
Liberia	0.9	4.6	0.4	4.9	-0.8	-0.9	-1.0	-1.3	-4.0
Bangladesh	0.9	7.2	0.7	7.9	-3.9	-1.1	-0.7	-1.3	-7.0
Vietnam	0.8	7.1	0.8	7.8	-2.8	-1.5	-0.9	-1.8	-7.0
Guinea Bissau	0.8	5.5	0.5	6.0	-0.9	-1.4	-0.6	-2.3	-5.2
Togo	0.7	7.1	2.8	9.9	-0.9	-2.0	-4.0	-2.3	-9.2
Burkina Faso	0.7	6.1	1.1	7.3	-2.5	-0.6	-1.7	-1.9	-6.5
South Africa	0.5	4.2	0.8	5.0	-0.1	-3.7	0.0	-0.7	-4.5
Moldova	0.2	2.9	0.4	3.3	-0.6	-1.0	-0.0	-1.4	-3.1
Burundi	0.1	9.0	0.5	9.5	-6.2	-0.7	-0.6	-1.8	-9.4
Kyrgyz Republic	0.0	3.2	87 0.4	3.6	-0.7	-0.9	-0.3	-1.6	-3.6
Average	2.1	6.4	0.7	7.1	-1.6	-1.2	-0.8	-1.5	-5.0

Notes: Authors' calculations. The gain from trade, expressed in percentage points, is the population weighted average of the proportional change in household real expenditure.

Table D4
Alternative Model
Gains from Trade - Losers

	Gains	Expenditure			Income				
		traded	non-traded	total	agric.	wage	enter.	rev.	total
Cambodia	-3.2	5.4	0.6	6.0	-4.5	-0.9	-0.7	-3.1	-9.2
Bhutan	-1.9	13.8	2.2	16.0	-3.2	-5.7	-0.3	-8.7	-17.9
Sri Lanka	-1.9	4.1	1.3	5.4	-1.4	-2.3	-2.5	-1.0	-7.3
Madagascar	-1.4	3.9	0.2	4.2	-2.3	-1.0	-0.6	-1.7	-5.6
Mauritania	-1.2	6.3	0.2	6.5	-1.1	-0.1	-0.0	-6.5	-7.7
Ghana	-1.2	3.9	2.3	6.1	-1.2	-4.2	0.0	-1.8	-7.3
Rwanda	-1.1	5.1	0.4	5.5	-2.6	-2.0	-0.4	-1.6	-6.6
Mali	-0.9	2.6	0.3	3.0	-1.0	-0.5	-0.5	-2.0	-3.9
Comoros	-0.4	3.0	0.7	3.6	-0.7	-0.8	-0.6	-2.0	-4.0
Mongolia	-0.2	3.4	0.1	3.4	-0.7	-0.4	-0.1	-2.4	-3.6
Average	-1.3	5.1	0.8	6.0	-1.9	-1.8	-0.6	-3.1	-7.3

Notes: Authors' calculations. The gain from trade, expressed in percentage points, is the population weighted average of the proportional change in household real expenditure.

Table D5
Inequality Adjusted Gains from Trade
Alternative Model

	G(0)	G(0.5)	G(2)	G(7)
Cameroon	5.9	5.8	5.5	4.6
Zambia	5.6	5.7	5.8	6.0
Nigeria	5.0	4.9	2.8	-5.5
Tanzania	4.5	4.5	4.8	5.4
Central African Republic	4.4	4.8	6.0	6.6
Sierra Leone	4.1	3.4	2.1	1.7
Jordan	4.0	4.2	4.9	4.7
Uzbekistan	3.6	3.2	2.3	1.1
Cote d'Ivoire	3.3	3.1	2.2	1.5
Egypt	3.1	3.0	2.6	2.1
Ukraine	3.1	3.0	2.9	2.6
Kenya	2.7	2.8	2.0	-3.9
Mozambique	2.6	2.2	0.9	-1.2
Benin	2.5	1.8	-0.2	-3.0
Armenia	2.3	2.2	2.0	1.8
Papua New Guinea	2.2	2.3	2.2	-3.2
Ecuador	2.2	2.6	3.5	3.7
Azerbaijan	2.1	2.1	2.1	1.8
Guinea	2.1	2.0	1.8	2.1
Niger	1.9	1.7	1.1	1.3
Indonesia	1.9	2.1	2.4	2.2
Yemen	1.7	2.0	2.3	2.8
Nepal	1.7	1.8	1.7	1.5
Tajikistan	1.6	1.6	1.4	1.2
Nicaragua	1.6	1.8	2.5	3.2
Uganda	1.5	1.5	2.1	4.8
Iraq	1.5	1.4	1.3	1.1
Bolivia	1.5	1.5	1.1	0.1
Ethiopia	1.4	0.9	-0.0	-1.2
Pakistan	1.4	1.8	3.0	3.4
Guatemala	1.3	1.4	1.7	2.1
Malawi	1.1	0.8	-0.0	-0.4
Gambia, The	1.0	0.7	-0.7	-1.1
Georgia	1.0	1.0	0.9	0.7
Liberia	0.9	0.8	0.5	0.2
Bangladesh	0.9	0.6	-0.1	-1.5
Vietnam	0.8	0.6	-0.0	-1.8
Guinea Bissau	0.8	1.4	2.6	5.9
Togo	0.7	0.7	0.7	0.3
Burkina Faso	0.7	0.0	-1.1	-2.4
South Africa	0.5	0.7	1.4	1.2
Moldova	0.2	0.2	0.4	0.9
Burundi	0.1	-1.4	-2.4	-3.8
Kyrgyz Republic	0.0	-0.0	-0.2	-0.1
Mongolia	-0.2	-0.1	0.2	0.6
Comoros	-0.4	-0.5	-1.0	-1.8
Mali	-0.9	-0.7	0.4	0.8
Rwanda	-1.1	-0.6	1.6	3.9
Ghana	-1.2	-0.8	0.1	0.0
Mauritania	-1.2	-0.8	0.4	2.5
Madagascar	-1.4	-1.6	-1.9	-2.7
Sri Lanka	-1.9	-0.9	0.9	1.8
Bhutan	-1.9	-1.5	-0.8	-2.2
Cambodia	-3.2	-3.1	-3.2	-3.5
Average	1.5	1.5	1.4	0.9

Notes: Authors' calculations based on household survey data. The average income shares are expressed in percentage points.